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Center for Research, Technology and Education in Vitreous Materials – CeRTEV
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1. SUMMARY OF THE PROJECT OBJECTIVES .

Through fundamental research on structure-property relations, using complementary simulation, spectroscopic and functional characterization methods, we are developing new active glasses and glass-ceramics (GC) with promising applications. For that, the core group of the Center consists of 14 professors at UFSCar, USP and UNESP (located in São Carlos and Araraquara, within 30km from each other) who are experts in engineering, chemistry and physics of vitreous materials, glass crystallization and a wide range of structural and functional characterization techniques and properties. They advise about 50 students and post-docs engaged in glass and GC research and are embedded in a large Brazilian and international network of collaborations.

We are researching and developing new active glasses and glass-ceramics presenting application-relevant functionalities, such as high mechanical strength and electrical conductivity, biological, optical or catalytic activity, and/or combinations of these properties. A fundamental understanding of these properties is sought on the basis of the structural organization of these materials on different length scales. To this end, we are applying state-of-the art NMR, EPR, EXAFS and vibrational spectroscopies to characterize the local and medium-range order, as well as the full resolution range of optical and electron microscopies, XRD and microanalyses for elucidating nano- and microstructures. This comprehensive experimental approach is being complemented by molecular dynamics simulations. Using this experimental and modeling strategy, we are further seeking a fundamental understanding of glass sintering and crystallization in terms of the mechanisms, thermodynamics and kinetics of viscous flow, as well as crystal nucleation and growth, enabling us to exercise control of these processes by developing appropriate forming process and thermal treatment protocols. In a concerted effort, the participating laboratories are jointly investigating a number of important benchmark systems, which are deemed particularly promising for applications either as structural reinforcement materials (dental and bio glass-ceramics), optical materials (laser glasses), materials for electrochemical energy storage devices (electrolytes, high-temperature seals), and catalytically active systems. Our research agenda is complemented by continuous education and outreach activities at different levels as well as by technology development and transfer. We intend CeRTEV to develop into a state-of-art center for research, innovation, and education in the field of glass science and glass-ceramics.

The CeRTEV Education and Outreach strategies and plan of action are divided in two main groups: *the first* is focused on the development of professional qualifications in glass science and technology, while *the second one* is focused on the diffusion of both basic and glass science. Being aware of the lack of professional training courses dedicated to the glass industry, which impinges upon its development, we consider it a high priority to remedy this situation. To this end, we are developing a comprehensive course, which will result in trained professionals for the glass industry. For this purpose, we are working with two professional organizations, the ABIVIDRO and the Paula Souza Center. Regarding our effort on diffusion, our strategy comprises multiple measures, which will be fully discussed later on in this report.

The research insights obtained from the CeRTEV activities will be channeled for generation of new technologies and patents, all the way to new products and production processes ("science to business approach"). We aim at the development of new or improved, patentable glass or glass-ceramic materials in each field of application above: 1) light armors (for use in airplanes, cars and individuals) and tougher monolithic glass-ceramics for dental restoration. We will work closely with some companies, such as Vitrovita and Cellmat; 2) macroporous and hierarchically ordered scaffolds, fibers, small monolithic parts and powders with increased osteoinductive activities, combined with the ability for targeted drug delivery for bone and tissue repair. Our industrial collaboration network in this area also includes Vitrovita, Vetra, Exactaderme, DMC; 3) fast-conducting solid electrolytes for lithium ion batteries. Lithium ion cells in which these electrolytes are being implemented will be developed in São Carlos and tested in collaboration with the Münster Electrochemical Energy Technology center in Germany, a joint academic and industrial platform dedicated to the development

of high-energy and high-power lithium ion batteries. We also aim at designing new glass-ceramic seals for fuel cell applications. The Brazilian giants Petrobras and Itaipu are interested in these materials; 4) solid state lasing materials with enhanced emission characteristics. We intend to use our conceptual understanding and research expertise in crystallization and design for developing a novel application of transparent glass-ceramics.

2. INTRODUCTION AND GENERAL COMMENTS

The CeRTEV has 14 faculty who advise about 50 research students. They cover a very wide and complementary range of expertize (engineering, physics and chemistry of materials) and techniques. Seven faculty are dedicated to "glass" research, whereas the other seven members have previous experience with vitreous materials but also spend a fair fraction of their time with other types of materials.

Before we present and discuss the main results of our efforts on fundamental research, technology, education and outreach in this period, it is relevant to dwell on the role of the **International Advisory Board** (IAB) of our Center. Indeed, we have a very strong IAB, with 21 members from industry and academia, from different countries. They are all very knowledgeable glass scientists. Eighteen members have attended at least one of our 3 meetings; and several attended all 3 meetings: 10 attendees in the first meeting in Aachen, May 2014, 17 in São Carlos, October 2014, and 10 in Miami in May 2015.

The main practical suggestions resulting from these 3 board meetings were: there should be more interaction among the 14 faculty of the CeRTEV, more interaction of the CeRTEV faculty with the IAB members, more collaboration with theoreticians. It was further suggested that we publish some critical review papers, publish more articles in high impact journals, and interact more with the Brazilian industry. Our efforts in these directions are summarized below:

<u>i) More interaction among the 14 CeRTEV faculty:</u>

The following CeRTEV faculty have shared research projects:

- Nalin & Donoso = optical + EPR studies of optical glasses
- Eckert & De Camargo = optical + NMR studies of luminescent glasses and glass-ceramics
- Eckert, Schneider & Zanotto = Glass structure versus nucleation mechanism
- Peitl, Rodrigues & Zanotto = bioactive glasses and glass-ceramics
- Rodrigues & Eckert = NMR of ionic conducting glass-ceramics
- De Camargo & Nalin = optical spectroscopy studies of luminescent glasses and glass-ceramics
- Pizani, Rino & Zanotto = High temperature Raman + MD simulations of crystallization
- Mastelaro & Zanotto = EXAFS studies of crystallizing glasses
- Ferreira & Zanotto = GFA, sintering and concurrent crystallization of glasses
- Magon, Donoso, Zanotto, Eckert = On the mechanisms of nucleation and growth in PTR glasses
- Magon, Eckert & De Camargo = ESEEM studies of luminescent glasses

<u>ii) More interaction of the CeRTEV with the IAB</u>

The following CeRTEV faculty and IAB have shared research projects:

- Eckert & Pradel
- Magon, Donoso, Eckert, Zanotto & Glebov
- Eckert & Nakane
- Eckert & Aitken

<u>iii) More collaboration with theoreticians</u>

The following theoreticians have been invited to spend some time with us:

- Invited to CeRTEV in 2015: P. K. Gupta and B. Mockross
- Invited to CeRTEV in 2016: J. Du and J. W. Schmelzer

Other international visitors are planning to spend some time at LaMaV: Alex Priven, Vladimir M. Fokin, Jean Louis Souquet, Atiar R. Molla, Maurício Rodrigues…

iv) Publish some articles in high impact journals:
Most materials science and engineering journals - especially those dedicated to glasses and ceramics, where we normally publish our "glass" articles and where most of our readers are focused - have impact factors within the range **0.5** to **3.0**. Some Board members have suggested that we should submit at least some articles to journals of "higher impact". Most of these higher impact journals are not dedicated to glasses and ceramics, but could be a good test of our capabilities. We list below the most recent results of our attempts to reach such journals:

- **Characterization and biocompatibility of a fibrous glassy scaffold**
  O. Peitl, E.D. Zanotto et al.
  J. Tissue Engineering and Regenerative Medicine 02/2015; **4.43 Impact factor (IF)**

- **Crystallization toughening of a model glass-ceramic**
  E.D. Zanotto et al.
  Acta Materialia 01/2015; 86(1):216-228. **3.94 IF**

- **Injectable composites based on biosilicate^{R} and alginate: handling and *in vitro* characterization**
  O. Peitl, E.D. Zanotto et al.
  RSC Advances 2014; 4(84):45778-45785. **3.71 IF**

-30-year quest for structure nucleation relationships in oxide glasses – E.D. Zanotto, J. Tsuchida, J.F. Schneider, H. Eckert – accepted IMR (2015). **IF = 7.5**

- **First evidence of P-O-B^{III} linkage in alkali and silver borophosphate glasses by high field correlation NMR,**
  G.Tricot, A.Pradel, H. Eckert et al., Chem.Commun. 2015; **IF**= **6.72**

- **Charge compensation in RE^{3+} (RE=Eu, Gd) and M^{+} (M=Li, Na, K) co-doped alkaline earth nanofluorides obtained via microwave assisted synthesis from ionic liquids**,
  C. Lorbeer, F. Behrends, A. V. Mudring, H. Eckert, J. Mater. Chem. C2, 9439-9450 (2014) **IF = 6.62**

- **Intermediate role of gallium in oxidic glasses: Solid State NMR structural studies of the Ga_2O_3-$NaPO_3$ System**,
  J. Ren, H. Eckert, J. Phys. Chem. C 118, 15386-15403 (2014).
  RSC Advances 2014; 4(84):45778-45785. **IF = 4.84**

v) Write some relevant review papers:
The Board also suggested that relevant review articles could be good for the community and to advertise the CeRTEV. The following reviews have or are being prepared or planned by our team:
Mauro & Zanotto - 200 years of glass science and tech - IJAGS (2014)
Maziar, Shiv & Zanotto - Assessment of glass-ceramics research and commercialization- ACerS Bulletin (2015)
Zanotto et. al. – 20 years of BioSilicate accepted JNCS (2015)
Zanotto, Tsuchida, Schneider & Eckert – 30-year quest for structure nucleation relationships - accepted IMR (2015)

Review papers planed for 2015 - 2016:
Mastelaro - EXAFS in glasses
Ferreira & Zanotto- DSC techniques for characterizing glass crystallization
Rino- MD simulations of relaxation processes in glass-forming liquids
Donoso & Magon – EPR studies of glasses
Eckert & Schneider – NMR studies of glasses
Serbena & Zanotto - Mechanical properties of glass-ceramics
De Camargo & Nalin - Optical properties of transparent glass-ceramics

Rodrigues - Ionic conducting glasses and glass-ceramics

vi) Interact more with the Brazilian industry:
A university-industry workshop and "Open day" to industrial engineers and researchers is scheduled for September 11, 2015.

-Congresses Organized by the CeRTEV faculty
"X Brazilian Symposium on Glass and Related Materials" (X-BraSGlass, http://www.xbrasglass.com.br/). São Carlos, October 2014 José F. Schneider e Andrea S.S. de Camargo, chairpersons

"GOMD- DGG" meeting, Miami, USA, May 2015 - Edgar D. Zanotto, executive committee of the GOMD

"Glass crystallization and glass-ceramics" E.D. Zanotto - One-day session during the GOMD-DGG, Miami, USA, May 2015

-Visitors: 17 members of the international advisory board and about 10 professors of different universities

-Website: We have also produced and maintain a rich website with a number of glass research news, lectures, educative videos, etc**.** The reviewers are cordially invited to navigate at www.certev.ufscar.br for more detailed information

3. PROGRESS IN THE PERIOD RELATED TO THE REFERENCES OF ITEM (9).

Research Progress

3.1. Overview

The **Ce**nter of **R**esearch, **T**echnology, and **E**ducation in **V**itreous Materials (CeRTEV) comprises 14 principal investigators and their co-workers at the Federal University of São Carlos (UFSCar), the University of São Paulo (USP), (both located in São Carlos) and the State University of São Paulo (UNESP, Araraquara). The principal investigators heading these groups are experts in vitreous materials, their crystallization and in a wide range of structural and functional characterization techniques. They advise about 60 graduate students and post-docs engaging in glass and glass-ceramic research, and are embedded in a large Brazilian and international collaboration network. As part of the joint CeRTEV research agenda, these groups work together to develop new active glasses and glass-ceramics, presenting application-relevant functionalities such as high mechanical strength, electrical conductivity, biological, optical or catalytic activity, and/or combinations of these properties. The synthesis efforts, which use both classical design strategies based on glass synthesis and controlled annealing as well as modern sol-gel-based self-assembly methods, are combined with detailed fundamental studies aiming at an understanding of (a) how composition and microstructure control the structural and dynamical properties of glass-ceramics and (b) how the latter relate to macroscopic physical and functional properties.

The status of current glass-ceramic research and technological development has been summarized in a recent review article [1]. Fundamental issues of key interest include the effects of liquid phase separation on crystal nucleation, tests and development of models of crystal nucleation, growth, and overall crystallization, metastable phase formation, surface crystallization, glass stability against devitrification, glass-forming ability, correlations between the molecular structure and nucleation mechanisms, sintering with concurrent surface crystallization, and diffusional processes

that control crystal growth. Despite the significant advancement in the knowledge about several aspects of phase transformations in glasses, glass crystallization remains an open, rich field to be explored [2,3].

The research agenda of CeRTEV is sub-divided into five core areas, dedicated to the five principal application fields of glasses and glass ceramics: (1) *structural reinforcement materials* for architecture and construction, armor, as well as dental restoration, (2) *bioglasses and glass-ceramics* for bone healing and growth, (3) *ion-conducting materials* for applications in modern energy technologies, (4) *photonic glasses and glass ceramics,* and (5) *catalytically active systems.* All these application areas benefit from fundamental research encompassing the development of general concepts regarding the structural description of glasses and the structural, kinetic and mechanistic aspects of the nucleation and crystal growth processes involved in the crystallization of glasses leading to glass-ceramics, as described in more detail below.

3.2. Fundamental Issues

3.2.1. Nucleation Mechanisms and Transport Studies

Over the past three decades, researchers have investigated the existence of possible relationships between crystal nucleation kinetics and the molecular structure of silicate glasses. The main driving force for this quest was the fact that while the vast majority of glass forming substances only undergoes surface (heterogeneous) nucleation when sufficiently heated, a few systems also show the thermodynamically less favorable case of internal (homogeneous) nucleation on laboratory time/length scales. For such glass systems various macroscopic properties such as densities, configurational entropies and frozen-in birefringence have suggested that the structure in the glassy state shows a closer resemblance to the structure of the phase formed upon crystallization than in the case of glass systems only undergoing heterogeneous nucleation. However, the specific structural features and their length scales have remained uncertain. In a comprehensive review article [2] we review and discuss research investigating relationships between the occurrence of internal nucleation and structural parameters related to various different length scales. The latter include (1) short-range order, concerning both network modifier cation-oxygen distances and coordination numbers as well as network former Q^n distributions, (2) intermediate range order describing network former connectivities, network former/network modifier correlations, and network modifier distance distributions, and (3) medium range order as reflected by silicate tetrahedral ring-size statistics. Inspection of this data for several stoichiometric oxide glasses and their respective isochemical crystals suggests a positive correlation between homogeneous nucleation ability and structural similarity at the level of short- and intermediate range order of the network modifier cations. In contrast, no correlation can be found with regard to any structural parameters describing the <u>local</u> structures of the network former species (Q^n distributions). Based on the limited set of data available, we develop concrete recommendations for future experiments to test this hypothesis [2].

Diffusion mechanisms in lithium disilicate melt have been studied using molecular dynamics simulations, reproducing the experimental diffusion coefficients with excellent accuracy [4]. Based on the diffusion coefficient of silicon, the glass-forming liquid is shown to obey the Stokes-Einstein relation at least down to 1600 K. The relaxation obtained via the self-part of the intermediate scattering function decouples from viscosity measurements at temperatures below 2000 K. Additionally, an analysis on the dynamical behavior of slow-diffusing atoms reveals explicitly the presence of dynamical heterogeneities. An extension of this work to barium disilicate melts, another material known to undergo homogeneous (volume) nucleation, is currently underway [5]. At this point, very promising initial results have been obtained: the interaction potentials developed yield excellent agreement with neutron diffraction structure factors and vibrational density of states.

The crystal nucleation (I) and growth (U) rates of $Na_2O{\cdot}2CaO{\cdot}3SiO_2$ glasses with increasing additions of Li_2O have been measured for the primary crystalline phase over wide and overlapping temperature intervals [6]. A partial section of the phase diagram $Na_2O{\cdot}2CaO{\cdot}3SiO_2$-$Li_2O$ was constructed via DSC analysis and shows a narrow range of solid solution formation that is close to that of $Na_2O{\cdot}2CaO{\cdot}3SiO_2$. In the four-component system (Na_2O-Li_2O-CaO-SiO_2), a pseudo-binary eutectic system of $Na_2O{\bullet}2CaO{\bullet}3SiO_2$-$Li_2O{\bullet}SiO_2$ exists. The role of Li_2O in the formation of the crystalline

phases was investigated using DSC and X-ray analyses. The addition of Li_2O results in decreases in the glass transition (T_g) and liquids (T_L) temperatures. With increasing Li_2O content, both the reduced glass transition temperature T_{gr} ($T_{gr} = T_g/T_L$) and the fragility index, m, pass through a minimum. These findings extend and confirm the known inverse correlation between T_{gr} and I_{max} (lower values of T_{gr} correspond to higher values of I_{max}) and provide evidence for a similar correlation between m and I_{max}.

3.2.2. New Experimental Characterization Methods

Structural investigations on glasses and glass-ceramics benefit greatly from new methodologies and techniques for the acquisition of structural information at the atomic/molecular scale. Within CeRTEV, technique-oriented research of this kind is under active development. One subject of key interest concerns the accurate measurement of nucleation rates. It had been previously proposed that this measurement can be done by evaluating the areas under the differential scanning calorimetry (DSC) crystallization peaks of partially crystallized glass samples. As described in our previous report, we had explored this method in detail for lithium disilicate glass, a material of great fundamental interest and technological importance [7]. In a continuation of this work we have now evaluated the effect of particle size on the crystallization mechanism of lithium disilicate (LS_2) glass samples (within the range of less than 105 to 850 μm) using differential scanning calorimetry [8]. The activation energies for the overall crystallization (E) and the Avrami coefficient (n) were evaluated using different no isothermal models. As expected, the coarse particles mainly crystallize in the volume, while surface crystallization was predominant in the samples with particle sizes of less than 350 μm. This result was confirmed through SEM analysis of the double stage heat-treated samples. In contrast with previous studies, our results demonstrated that the activation energy decreases as the particle size increases.

In new collaborative work within CeRTEV, we developed a novel ^{29}Si solid state NMR approach for measuring the rate of crystallization in lithium disilicate glass ceramics [9]. While the signals of the crystalline and glassy fractions are clearly distinguishable by traditional ^{29}Si magic-angle spinning NMR, is approach is not feasible in practice as the ^{29}Si spin-lattice relaxation times are extremely long, thereby complicating rigorously quantitative applications. It could be shown, however, that greatly enhanced ^{29}Si NMR signals can be obtained via ^{7}Li->^{29}Si cross-polarization and that this method can be calibrated to yield quantitative nucleation rates consistent with those determined by optical microscopy and x-ray powder diffraction [9]. During the course of this work we noted further that the ^{7}Li spin-lattice relaxation times depend sensitively on the conditions of the crystallization process, suggesting that this (easily measureable) observable may allow an even more effective approach for measuring crystallization rates in lithium silicate glass-ceramics.

3.3. Structural Reinforcement Materials

Because of their unique thermal stability and shock resistance glass-ceramics are ideally suited for applications as materials for *armor* and *restorative dentistry*. The intrinsic fracture toughness and flexural strengths of glass-ceramics originate from their uniform microstructures, i.e. narrow grain size distribution, special crystal shapes and lack of voids. Research at CeRTEV has been devoted both to developing and testing new glass-ceramic formulations as well as improving the mechanical properties of well-established ones. With regard to the latter, a detailed study of the toughening mechanism of stoichiometric lithium disilicate glasses has been examined [3]. Crystallized specimens were prepared using carefully designed and controlled two-stage heat treatments to give different crystallized volume fractions while maintaining a constant grain size of approximately 12 μm. This original procedure allowed us to separately control the effects of these two micro structural parameters on the mechanical properties of the glass-ceramic. The hardness, elastic modulus, four-point bending strength, indentation fracture toughness and double-torsion fracture toughness were measured for samples with different crystallized volume fractions, ranging from the parent glass to fully crystallized samples. We found that the bending strength increases rapidly with crystallization at crystal volume fractions below 10% and reaches a value 2.5 times greater than that of the original glass. For a fully crystallized sample, the fracture toughness increases almost fivefold, from 0.75 to 3.5 $MPa.m^{1/2}$. Laser confocal

microscopy was used to reveal the topography of the fracture surfaces. Three mechanisms that contribute to toughening - crack deflection, crack bowing and trapping, and crack bridging - were evaluated. A model incorporating the elastic modulus, crystal fracture toughness and crystallized volume fraction was proposed and successfully tested to explain the increased fracture toughness with crystallized volume fraction for the full range of crystallization in LS_2 glass-ceramics.

3.4. Bioactive Glasses and Ceramics

3.4.1. Applications of Biosilicate in Bone Repair.

Research at CeRTEV on bioactive glasses focuses on the continuing improvement of osteoconductive and osteoinductive materials for stimulating bone healing and growth, by developing and testing new bioactive formulations and composites and comparing their performances to the "golden standard" glass denoted "45S5" developed by Professor Hench and co-workers. In a critical review we have analyzed 28 doctoral theses and masters dissertations and over 30 publications that tested Biosilicate®, a highly bioactive glass-ceramic, in a number of applications throughout the past 20 years [10]. This material presents a combination of positive features for bone tissue regeneration: it is highly bioactive, osteoconductive, osteoinductive, non-cytotoxic, non-genotoxic and has antibacterial properties. In addition, in the monolithic form, it is quite strong and tough. Its in vitro bioactivity is similar to that of Bioglass 45S5. It can be applied in powder, monolithic and 3D scaffold forms that could be easily machined during surgical procedures and has been successfully tested in a number of in vitro, in vivo and clinical studies [10]. In further work conducted during the past year we have tested Biosilicate®, for numerous applications in bone repair [11-14]. In particular its efficacy in osteoporotic conditions has been tested both Biosilicate® and Bio-Oss® another commercially available formulation. For the healthy condition both Biosilicate® and Bio-Oss® do not improve bone formation after 4 weeks. Histomorphometric evaluation of osteoporotic bone defects with bone substitutes showed more bone formation, significant for Bio-Oss®. Molecular biological evaluation was performed by gene-expression analysis. The relative gene expression was increased in many instances with both materials, suggesting that bone defects in osteoporotic conditions can be efficiently treated with both of these two bone substitutes.

3.4.2. Integration of Biosilicate into dental cements.

Bioactive glasses are surface-active and able to induce remineralization of dentin [15]. Two resin-modified glass-ionomer cements (RMGICs) doped with bioactive glass (Biosilicate®) were used as restorative materials in dentin. To this end, cavity preparations were performed on 30 noncarious human molars and restored with the tested materials. Teeth were stored in water (37 °C) for 24 h or 7 days, sectioned into beams and tested for failure in tension (0.5 mm/min).Two weight percent of Biosilicate® into RMGICs produced an increase in microtensil bond strengths, while not affecting the compressive strengths.

3.5. Glasses and Glass-Ceramics for Applications in Modern Energy Technologies.

Glass-ceramics have shown significant promise for applications as solid electrolytes in high energy storage devices. The highest lithium ion conductivities in the solid state are generally encountered in crystalline compounds with highly disordered cation sub-lattices, termed *superionic crystals*. Nevertheless, ion conducting glasses are often preferred in practice as they do not suffer from grain boundary effects and may present more homogeneous interfaces with the anode and cathode compartments of a solid state electrochemical cell. The glass-ceramic route is a favorable alternative to classical sintering methods because it allows much easier control of the microstructure than the latter. Numerous promising systems presenting electrical conductivities in excess of 10^{-3} $(\Omega.cm)^{-1}$ at room temperature exist. The CeRTEV research agenda focuses on the further development of such systems, based on a solid understanding of composition – structure – performance relationships. Rather than attempting the development of completely new compositions, we are seeking a better understanding of what the limitations of the current *lead-materials* are and how they can be overcome.

3.5.1. Glass-ceramics based on the NASICON structure.

One particularly attractive system is based on the crystallization of precursor glasses in the highly conductive NASICON structure. These systems are based on the $LiTi_2(PO_4)_3$ composition, and their ionic conductivity can be enhanced further by aliovalent ion substitutions, e.g. Al^{3+} on Ti^{4+} and/or Si^{4+} or Ge^{4+} on P^{5+} sites, resulting in rather complex compositions denoted as $Li_{1+x+y}Ti_{2-x}Al_xSi_yP_{3-y}O_{12}$ (LATP). While Previous CeRTEV activities had focused on crystallization kinetics studies [16] and the structural aspects of the crystal to glass transition [17], we are now in the process of investigating the relationship between the microscopic cation dynamics (studied by temperature-dependent $^{6/7}Li$ lineshape and stimulated echo measurements and the macroscopic transport properties, measured by measured by impedance spectroscopy. The evolution of these observables is studied as a function of the crystalline fraction, which is being controlled by the annealing time. Most recently, we have extended our investigations to sodium-based glass-ceramics (NTP). An enhancement of the electrical conductivity is observable in both the Ge -> Al+Li and the P -> Si+Li substitution systems [18].

3.5.2. Non-linear Composition/Property Relations in Ion-conducting Glasses.

A general approach in tailoring the performance of glasses to specific applications is based on fine-tuning the chemical composition. When this general principle is applied to ion-conducting glasses one frequently encounters strikingly non-linear changes in physical properties (such as the glass transition temperature and the ionic conductivity). Network former mixing can result in substantial increases (positive MNF) or decreases (negative MNF) upon ionic conductivities. For making optimal use of such effects in compositional design, a detailed structural understanding of the "***mixed network former effect***" is sought on the basis of advanced solid-state NMR methods. Tellurium containing mixed networks are of interest, as their high electronic polarizability tends to promote ionic mobility and transport. A positive MNFE upon glass transition temperatures and ionic conductivities is observed in the system $(Na_2O)_{0.33}[(2TeO_2)_x(P_2O_5)_{1-x}]_{0.67}$, within the composition range $0 < x < 0.5$ [19]. Structural studies by ^{31}P, ^{23}Na, and ^{125}Te high-resolution and dipolar solid state nuclear magnetic resonance (NMR) techniques, O-1s X-ray photoelectron spectroscopy and Raman spectroscopy have led to quantitative structural model that provides a detailed description of network modification processes, interactions and connectivities. For x-values < 0.5, the data evidence a preferential formation of Te-O-P linkages, whereas at higher x values, the connectivity distribution appears to be more random. ^{23}Na NMR data suggest a dominant association of the network modifier species with the phosphate species for $x < 0.5$, whereas for larger x values the participation of nonbridging oxygen atoms associated with tellurium becomes increasingly evident in $^{23}Na\{^{31}P\}$ rotational echo double resonance (REDOR) results. The structural results are discussed in relation to bulk properties (molar volumes, glass transition temperatures and ionic conductivities) as a function of composition.

In contrast to the above results, a negative MNFE has been observed in $(Na_2O)_{0.33}[(2TeO_2)_x(B_2O_3)_{1-x}]_{0.67}$[20], All the XP spectra can be satisfactorily fitted with two lineshape components with the parameters of the binary end-member glasses, providing no evidence for the possible formation B-O-Te linkages. In addition, none of the ^{125}Te and ^{11}B NMR data show significant proof of such linkages, even though their formation cannot be explicitly excluded. ^{23}Na NMR data indicate a monotonic chemical shift trend consistent with proportional sharing of the network modifier between the two network former species. The negative mixed-network former effect can thus be rationalized on the basis of an avoidance of B-O-Te linkages and incipient phase separation.

In collaboration with Advisory Board member Prof. A. Pradel, our previous structural studies on alkali borophosphate glasses have been extended to the more alkali-rich compositions $(M_2O)_{0.45}[(B_2O_3)_x(P_2O_5)_{1-x}]_{0.55}$ (M = Li, Na, K, Rb, Cs, Ag) [21]. Neither the type of the monovalent cation nor the thermal history of the glasses exercises a significant influence upon the borate and phosphate speciations and connectivities. While there is literature consensus regarding the formation of B(IV)-O-P connectivities in borophosphate glasses, previous experimental evidence for B(III)-O-P linkages had been ambiguous. Using a novel pulse sequence stimulating heteronuclear double quantum coherences based on indirect spin-spin interactions, the existence of B(III)-O-P connectivities

was proven beyond doubt. This finding suggests that the structure of alkali borophosphate glasses is more homogeneous than previously thought.

Melt-quenched $(NaPO_3)_{1-x}(Ga_2O_3)_x$ glasses ($0 \leq x \leq 0.35$) were studied in a similar fashion, using state-of-the-art solid state NMR methodologies [22]. Alloying $NaPO_3$ glass by Ga_2O_3 results in a marked increase in the glass transition temperature, similar to the effect observed with Al_2O_3. As simple ^{31}P MAS-NMR spectra are poorly resolved, new spectral filtering strategies, based on the excitation of double-quantum transitions were introduced to simplify the spectra and to assist line shape deconvolutrion. Ga^{3+} is dominantly found in six-coordination in low-Ga glasses, whereas in glasses with higher Ga-contents lower-coordinated Ga environments are increasingly favored. The connectivity between P and Ga was assessed by hetero nuclear $^{71}Ga/^{31}P$ dipolar recoupling experiments. Up to x = 0.25, the second coordination sphere of all the gallium atoms is fully dominated by phosphorus atoms. Above x = 0.25, ^{71}Ga static and MAS NMR as well as REDOR experiments give clear spectroscopic evidence of Ga-O-Ga linkages. Based on these results a comprehensive structural model is developed, which explains the compositional trend of the glass transition temperatures in terms of the concentration of bridging oxygen species (P-O-P, P-O-Ga, Ga-O-Ga) in these glasses. The results provide new insights into the role of Ga_2O_3 as an intermediate oxide, with features of both network modifier and network former in oxide glasses.

3.5.3. Cation dispersion in mixed phosphate glasses.

The random mixing of different mobile ions is considered one of the fundamental structural factors leading to the mixed ion effect (MIE) in mobility-dependent properties such as d.c. conductivity or chemical stability. This has been confirmed for mixtures of monovalent ion species in metaphosphate glasses, with only moderate deviations from a strictly random regime at some compositions. More significant deviations from the random dispersion have been identified for Na-Sr polyphosphate glasses (P_2O_5<0.50 mol fraction) [R. Pires, I. Abrahams, T.G. Nunes, G.E. Hawkes, J. Non-Cryst. Solids 337 (2004) 1–8]. Using solid state NMR, we systematically explored the mixing of monovalent (Na^+, Li^+, Rb^+) and divalent (Sr^{2+}, Ca^{2+}) cations in two kinds of glass matrices: (1) glasses containing 43 mole% P_2O_5, (33% of Q^1 and 67% $Q^{(2)}$ units) and (2) glasses containing 50 mol% P_2O_5 (100% $Q^{(2)}$ units) [23]. The properties of Sr phosphates are of particularly interest, as Sr is used to substitute Ca with three main biological and clinical objectives: to increase x-ray opacity and to act as antibacterial agent in bioglasses used as dental/bone implants, and to to promote bone regeneration in the treatment of osteoporosis [N.J. Lakhkar, I. Lee, H. Kim, V. Salih, I.B. Wall, J.C. Knowles, Adv. Drug Delivery Rev. 65 (2013) 405–420]. For series (1), the glass transition temperature, molar volumes, and ^{31}P-NMR parameters change significantly when SrO constitutes 28 mole % of the modifier oxide inventory. This composition threshold is well-explained by a model assuming preferential bonding of the divalent cation with Q^1. In contrast, the dispersion of Sr seems to be random in all the glasses of series (2), including a system with three cations (Sr-Li-Cs). The average Na-O distance in these glasses as probed by the ^{23}Na NMR chemical shift increases monotonically with the substitution by both Ca^{2+} and Sr^{2+} pointing towards lower Na-O bond covalency due to charge transfer to those O interacting with the divalent cation. These findings might help to control the extent of the MIE in phosphate glasses, through the choice of divalent/monovalent species and the control of the population of Q^1 sites binding the divalent ions.

3.5.4. Electronically conducting glasses

Among oxide glass systems, vanadium tellurite glasses exhibit the highest electronic conductivity and thus high application potential. Structural studies as a function of composition indicate a critical V_2O_5 concentration of 45 mol %, above which the local structure is subjected to rather drastic changes with increasing V_2O_5 content leading to abrupt changes in both hardness and liquid fragility [24]. Electronic conductivity does not follow the expected correlation to the valence state of the vanadium as predicted by the Mott-Austin equation but shows a linear correlation with the mean distance between vanadium ions. The work gives insight into the mechanism of electron

conduction in the vanadium tellurite systems and may help in designing suitable formulations for electrochemical devices.

3.6. Glasses and Glass-Ceramics for Photonic Applications.

CeRTEV activities in this area are focusing on the development and characterization of new glasses and glass-ceramics doped with luminescent ions. Two distinct efforts have been under investigation during the past year: 1) new glass and glass ceramic formulations doped with transition metal and rare earth ions for laser and other luminescent applications, (2) the design and characterization of new glasses undergoing photothermal refractive and photocrystallization effects, and (3) the development of new luminescent nanocomposites. All of these efforts are accompanied by detailed structural studies, providing insights into the distribution and local bonding environment of the luminophores and the photochemical and photothermal mechanisms involved in effecting structural change.

3.6.1. New Formulations for Luminescent Glasses and Glass-Ceramics

Rare earth (RE^{3+})-doped fluorophosphate glasses are among the most promising candidates for high-efficiency laser generation in the near-infrared spectral region. By proper choice of composition, these materials can combine the advantages of fluorides (low phonon energies, low refractive indices, extensive optical window, low hygroscopicity) and of oxides (high chemical and mechanical stability and high dopant solubility), resulting in enhancement of the RE^{3+} emissive properties. During this past year researchers at CeRTEV have developed the synthesis and structural/spectroscopic investigation of new glasses with composition $25BaF_2$-$25SrF_2$-(30-x)$Al(PO_3)_3$-x AlF_3-(20-z)YF_3:zREF_3, where x = 20 or 15, RE = Er^{3+} and/or Yb^{3+}, z = 0.25-5.0 mol% [25]. Results indicated considerable improvement of the emissive properties of both ions when compared to phosphate or even other fluorophosphates host compositions. Long excited state lifetimes (τ = 10 ms for the Er^{3+} level $^4I_{13/2}$, and τ = 1.3 ms for the Yb^{3+} level $^2F_{5/2}$) imply high fluorescence quantum efficiencies η (up to 85% for both ions). Structural characterization by Raman and multinuclear solid state NMR spectroscopies indicated that the metaphosphate-type chain structure of the $Al(PO_3)_3$vitreous framework is partially depolymerized and dominated by $Q^{(0)}$ and $Q^{(1)}$ units cross linked by six-coordinate Al species. The relative proportions of Al-PO_3 versus Al-F ligations have been quantified by $^{27}Al\{^{31}P\}$ rotational echo double resonance (REDOR) NMR results, suggesting a clear bonding preference between aluminum and phosphorus [26]. This result is consistent with the desired dominance of fluoride species in the local environment of the rare earth and alkaline earth atoms in these glasses. Complementary results have been obtained by echo-detected EPR spectroscopy. The constant line shape obtained in the glasses with the two highest fluoride content suggests a spectroscopic "fingerprint" of the rare-earth ion local environment completely dominated by fluoride ligands. At lower F levels, the spectroscopic changes suggest the formation of mixed-ligand environments. Building on this progress, samples co-doped with EuF_3 and TbF_3 were designed to generate tunable visible and white light upon excitation with suitable wavelengths, dispensing the need for a third blue emitting RE ion [27]. Four co-doped samples with equal amounts of and total concentrations of 0.3, 0.5, 1.0 and 1.5 mol% were tested. Their CIE chromaticity coordinates were calculated for various excitation wavelengths in the region from 350 to 360 nm allowing tuned emission from blue to red. The long lifetime values of the emitting levels in these co-doped samples (3.1 ms for Eu^{3+} ($^5D_0$ level) and 4.0 ms for Tb^{3+} (^{5}D4 level), associated with fairly high quantum yields (Q.Y. = 5-12%) indicate that these materials could be efficiently pumped by high power LEDs around 355 nm. The next step, and already ongoing, in the research of fluorophosphate compositions is the development of glass ceramics obtained by controlled heat treatments of the mother glasses. Some preliminary results indicate the crystallization of $SrYF_7$ in samples but up to this point particle size distribution is such that the optical quality of the final material is compromised. The expectation is that the rare earth dopants will favor the crystalline phase (as it is commonly found) and thus present crystal-like spectroscopic properties (e.g. higher emission cross sections).

Tungsten-phosphate glasses with the new composition $4(Sb_2O_3)$ 96-x(50WO_3 - 50$NaPO_3$)xEu_2O_3 ($0 \leq x \leq 1.0$) are also under investigation. They are obtained by melt-cooling and

characterized with respect to their physical and photophysical properties [28]. They present large densities (~4.6 g cm^{-3}), high glass transition temperatures (~480°C) and high thermal stability against crystallization. Upon excitation at 464 nm, the characteristic emissions of Eu^{3+} ions in the red spectral region are observed with high intensity. The Judd-Ofelt intensity parameters $\Omega_2 = 6.86 \times 10^{-20}$, $\Omega_4 = 3.22 \times 10^{-20}$ and $\Omega_6 = 8.2 \times 10^{-20}$ cm^2 are found to be higher than those reported for other phosphate glass compositions and comparatively long excited-state lifetimes are found. Based on these properties, these glasses may show potential for laser applications but considering the photochromic nature of the host, we also envision multifunctional applications. Current work focus on co-doping these glasses with $AgNO_3$ to obtain metallic nanoparticles that can potentially enhance the luminescent properties or RE ions, due to interaction via surface Plasmon resonance. There are several reports in the literature of both, luminescence quenching and enhancement and the mechanisms involved in both processes are not well understood. One consensus is that the efficiency of one or the other process is highly dependent on the size of the metallic nanoparticles, whose control has proven to be a major challenge. In addition, different species such as Ag^0 atoms, Ag^+ ions, nanoparticles, clusters, etc, play different roles and thus must be controlled.

Still in the research of tungsten-phosphate glasses, recently, spectroscopic studies have also been performed in Eu^{3+}-doped glasses with composition (100-x)[0.6$NaPO_3$-0.4WO_3] xPbF_2 where x = 0 to 60 mole [29]. In this case, there is a significant improvement of luminescent properties when PbF_2 concentration is increased due to provision of lower local phonon energies at the Eu sites.

The crystallization of glasses in the system $SbPO_4$-$PbGeO_3$-$MnCl_2$ glass was monitored by in-situ UV-Vis spectroscopy during thermal treatment [30]. While the glass presents only Mn^{2+} species the crystallization leads to of manganese to the trivalent state, as evidenced by an absorption band in the visible range and by complementary EPR investigations. High resolution transmission electron microscopy shows the presence of nano-crystalline phases of Mn_2O_3 and $PbGeO_3$ confirming the formation of a glass-ceramic.

3.6.2. Photothermal Refractive Glasses and Photo-crystallization Studies

Photo-thermo-refractive (PTR) glass is an optically transparent photosensitive calcium silicate glass, containing NaF, along with various dopants such as Ce^{3+}, Ag+, and tin and antimony oxides. UV-exposed regions of this glass produce NaF nanocrystals upon heating, giving rise to a permanent, localized refractive index change. The initial stages of this crystallization have been examined by electron paramagnetic resonance spectroscopy [31]. These studies have shown that UV exposure leads to the production of unpaired electrons, whose likely association with antimony atoms is suggested by pronounced spin-5/2 nuclear hyperfine splittings observable by the EPR data.

The influence of both thermal treatment and laser irradiation on the structural and optical properties of films in the Sb_2O_3-Sb_2S_3 system was investigated [32]. The films were prepared by RF-sputtering using glass compositions as raw materials. Irreversible photodarkening effects were observed after exposure the films to a 458 nm solid state laser. Raman scattering measurements indicate that photo-crystallization results in the formation of crystalline Sb_2S_3, whereas thermal annealing results in crystalline Sb_2O_3.

3.6.3. Inorganic-organic hybrid optical materials and nanocomposites.

The study of photoluminescent characteristics of host-guest systems based on highly emissive trivalent rare earth complexes such as Eu^{3+} bypiridine-carboxyl, immobilized in solid state host matrices, are motivated by the potential applications of these materials in optoelectronic devices and bioanalytical systems. Besides offering the possibility of designing a more favorable chemical environment to improve the photophysical properties of the guest molecules, encapsulation in the solids also protects such molecules, prevents leakage (especially critical for biological applications) and ultimately leads to more robust and versatile materials. Among the most interesting possible host matrices are mesoporous silicates and hybrids (organo-silicates) in the form of powders (MCM-41 like) and transparent bulk or film xerogels. Highly efficient red emitting materials were prepared

based on the wet impregnation of such host matrices with the new [^{t}Bu-COO]$_3$ Eu (tri[4-(4'-tert-butyl-biphenyl-4-yl)-2,2'-bipyridine-6-carboxyl] Eu(III)) complex [33]. Retention of the complex molecules is significant higher in the organo silicate samples than in the regular silicates. Increased excited state lifetimes (up to 2.1 ms, versus 1.8 ms for the complex in solution) and high quantum yields (up to 65%, versus 85% for the complex in solution) were measured for the bulk xerogel materials opening up the possibility of exploring these materials in the thin film form for lighting and bioanalytical applications. Other materials incorporating Ir (III) complexes and organic dyes had been previously carried out and currently we are also focusing on the development of hybrids based on Cu (I) halide cluster complexes whose photoluminescence properties are very sensitivity to the presence of oxygen. The results are very promising and indicate that the materials could be efficiently used as a highly sensitive sensor for oxygen sensors at quite low level. Furthermore, Pt (II) complexes have been incorporated in sol gel silica matrices and due to the high spin-orbit coupling the materials present high emission, especially when the molecules are in the aggregated stage. In all these cases, theoretical approaches to calculate the expected energy level diagrams and radiative properties are carried out through cooperations.

Di-ureasil organic-inorganic hybrids have been used together with Phosphotungstic acid (PWA- $H_3PW_{12}O_{40}$) in the preparation of new photochromic materials [34]. PWA was incorporated in different relative concentrations in di-ureasils displaying different organic chain lengths. The structure and photochromic behavior of these novel materials were investigated by means of infrared (FTIR), photoluminescence (PL) and Ultraviolet-Visible (UV-Vis) spectroscopies and Small Angle X-ray Scattering (SAXS) technique as a function of PWA content and also of the polymer chain length. Eu^{3+} has been incorporated as probe ion. For the short polymer chains, europium and PWA Keggin structures are located close to oxygen atoms of the polyoxides segments while for the long polymer chain carbonyl groups of the urea units contribute to the coordination. The dependence of photochromic effects and bleaching on the polymer chain length can be related to the nature of the sites where the PWA is coordinated to the matrix.

Phosphotungstic acid (HPW) dopants have also been incorporated into ormosil hybrid networks by the sol-gel method to yield reversible UV-dose-dependent photochromic materials [35]. The organic functionalities of ormosils (aminopropyl and butyronitrile groups) influence both the structure and photochromic behavior of these hybrid ormosil materials. Due to alkylammonium-phosphotungstate ion-pair formation ($-NH_3^+.PW_{12}O_{40}^{3-}$), APTS induces incorporation of higher amount of phosphotungstate in the dip-coated films leading to higher photochromic response of these films compared to the BuTS-bearing ones. On the contrary, in drop-casted films with the same phosphotungstate content, the photochromic response is the same for BuTS- and APTS-containing ormosil films. The photochromic response of both kind of films decreases upon dehydration of the films suggesting the importance of the presence of water in the photochromic behavior of these films.

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4. EDUCATION AND OUTREACH PROGRESS

4.1. Overview

The CeRTEV Education and Outreach strategies and plan of action are divided in two main groups: *Group A* focuses on the development of professional qualifications in glass science and technology, while *Group B* has as its main objectives the diffusion of basic and glass science.

We will describe below the main actions taken in group A and B, during this second year of CeRTEV´s activities.

4.2. Group A: Development of professional qualification strategies in glass science and technology

As pointed out and justified in our previous report, our main activity in this group is the development of a proposal for a technical course "Glass Technology" to educate trained professionals for the glass industry, in order to address the lack of vocational training in this field. For this project, our partners are the ABIVIDRO, (Associação Técnica Brasileira das Indústrias Automáticas de Vidro-Brazilian Association of Automated Glass Industry) and the Paula Souza Center, an organization of the São Paulo State Government which now administers 214 Technical Schools (ETECS) and 59 Faculties of Technology (FATECS) in 163 municipalities of the state of São Paulo.

The "Glass Technology" course is planned to be a three semester course. The certificate will be delivered after three semesters of specialization. Students may start this specialization in parallel to the second year of high school or at any time if they have completed the high school. The name of the diploma "Glass technology" or "Introduction to Glass Technology" is still preliminary.

During the last year, activities on the "curriculum laboratory" were held. Once per week, representatives from the Paula Souza Center and Dr. Mauro Akerman, a specialist in the Glass Industry indicated by CeRTEV, worked together to elaborate the curriculum of all disciplines to be offered in this three semester course.

As a result of this "curriculum laboratory", the description of the "Technical Vocational Qualification in Glass" (Habilitação Profissional de Técnico em Vidro) was proposed, including the details of the disciplines during the three semesters of the Glass technology course. The disciplines to be offered may be found in table 1:

Table 1: Curriculum of the "Glass Technology Course"

Curriculum - Module I – 1º (First) Semester - hours/class

Curricular components	**Theoretical**	**Practice**	**Total**
I.1 - Workplace Safety and Environment	50	00	50
I.2 - Chemical Process Engineering in glass Industry	00	100	100
I.3 - Glass Production	00	100	100
I.4 - Computerized applications	00	50	50
I.5 - Graphic Representation 2D and 3D	00	100	100
I.6 - Physical Processes Planning in Glass Industry	50	50	100
Total	**100**	**400**	**500**

MODULE I: Qualification at Intermediate Technical Level.

Curriculum - Module II – 2º (Second) Semester - hours/class

Curricular components	**Theoretical**	**Practice**	**Total**
II.1 - Instrumental English	50	00	50
II.2 - Language, Work and Technology	50	00	50
II.3 - Glass Raw Materials and its Application	00	50	50
II.4 - Planning and Analysis of Glass Composition	00	50	50
II.5 – Glass Preparation	00	100	100
II.6 - Operation of Melting Furnaces I	50	50	100
II.7 - Planning the final term paper (Monograph)	50	50	100

Total	**200**	**300**	**500**

MODULE I + II: Intermediate Level Technical Qualification Technical Assistant in Glass.

Curriculum - Module III – 3º (Third) Semester - hours/class

Curricular components	**Theoretical**	**Practice**	**Total**
III.1 - Entrepreneurship in Glass Production	50	00	50
III.2 - Development the final term paper (Monograph)	50	50	50
III.3 - Equipment maintenance in Glass Manufacturing	00	100	100
III.4 – Glass processing and Transformation	50	50	100
III.5 - Planning and Use of Refractory in Glass Industry	00	100	100
III.6 - Operation of Melting Furnaces II	50	50	100
Total	**150**	**350**	**500**

MODULE I + II + III: Enabling Technical Professional in glass.

The Curriculum of the Glass Technology Course (Table 1) was presented to the interested public in two separate meetings:

- the first one, in the Paula Souza Center, on April 13, 2015, was attended by the Superintendent Director of Paula Souza Center, Prof. Laura Laganá, the Vice-Rector of the Federal University of São Paulo, Prof. Adilson Jesus Aparecido de Oliveira, a representative from CEPID – FAPESP, Prof. Roberto Marcondes Cesar Junior, and other representatives from the Paula Souza Center and from CeRTEV.

In this meeting, Prof. Laura Laganá stressed that this will be a new course in whole Brazil, and because of that, this course must be recognized by the Brazilian Education Ministry (MEC). For this purpose, it would be beneficial if this course is offered also in other locations in Brazil.

- the second presentation meeting was held at ABIVIDRO, on May, 13th, 2015, with representatives of directors of human resources (Diretores de Recursos Humanos) of all industries associated with ABIVIDRO. This meeting was fruitful, since there were questions and suggestions concerning the course program.

The next step will be to decide in which city of São Paulo State the course will be first installed. This will be a joint decision between Paula Souza Center and CeRTEV. Concerning this subject the Director Superintendent of Paula Souza Center, Prof. Laura Laganá, strongly advised us to make our choice based not on "political wishes", but to analyze which city has already a Paula Souza Center with some laboratory infrastructure, and also an appropriate demand from the Glass Industry, which could guarantee the success of the course. The success of a technical course is measured based on the employability of graduates.

4.3. <u>Group B:</u> Diffusion of basic and glass science

4.3.1. ACIEPE

In continuation of what was described in our first report, CeRTEV offered during the past two semesters, an UFSCar/ACIEPE (Atividades Curriculares de Integração de Ensino, Pesquisa e Extensão, - activities for the integration of education, research and extension) event spearheaded by the UFSCar´s Rectorate. As pointed out in our previous report, in this activity, undergraduate students from UFSCar, under the supervision of a CeRTEV member and UFSCar faculty, have access to a public elementary school, in which they present and discuss some topic in basic science. In a second step, those elementary school students, aged 9-12 years, visit the Laboratório de Materiais Vítreos, LaMaV/DEMa/UFSCar, one of the main CeRTEV´s laboratories. CeRTEV´s ACIEPE is entitled "Engineers and Scientists of the Future".

The motivation for this activity comes from the well-documented fact that the fields of exact science and engineering experience difficulties in attracting new talented students. In Europe and also in the United States of America, many efforts with heavy economic investments have been made to modify the teaching methodology to remedy this situation, with unsatisfactory results thus far. The educational literature also reports that students above an average of 14 years, tend to not show any interest in the fields of science and engineering and that efforts to change their mind at that particular stage produces poor results.

It is easy to see that owing to the shortcomings of the Brazilian public school system (poor infrastructure and large student/teacher ratio) the vast majority of schools teach science without its essence - the scientific thinking process. The scientific thinking process (hereafter called "scientific method"), can be simplified in four basic steps: i) observation of a phenomenon, ii) development of a hypothesis to explain the observed phenomenon, iii) experiments to verify or refute the hypotheses and finally iv) a conclusion about the hypotheses (true or false).

The large amount of information to be transmitted and the excessive number of students in the classroom are the main reasons given by elementary and high school teachers to justify why this kind of approach to science knowledge is not feasible. Thus the teaching of science, in many schools, especially in elementary school, tends to become simply the memorization of facts and scientists. This kind of science class presents an inaccurate view of science and might be one of the reasons for students to lose interest in the field of physics, chemistry and engineering.

To try to help in the development of new strategies to convince the teachers that it is in fact possible to teach the scientific method in a very precise and interactive way, we developed an “extension activity project” (ACIEPE) linked to CeRTEV and the Department of Materials Engineering (UFSCar) with a new concept "Engineers and Scientists of the Future". In this activity, undergraduate students of UFSCar take classes on the structure of the scientific method through proposed problems on the general characteristics of ceramic and glass materials. Based on a proposed problem, assumptions are made to try to solve the problem (hypothesis) and experiments (thesis) are designed to test the hypothesis. After this training, undergraduate students and the supervisor will visit elementary public schools in São Carlos city to teach fifth grade students (around 10 years old). The concepts are taught to students via simple and low cost experimental methodology, figure 1. Two other goals of this project are the demystification of the University environment and of the scientists’ and engineers’ work. At the same time, these courses are a vehicle for training undergraduate students of the Federal University of São Carlos, to accurately transmit and disseminate scientific knowledge efficiently to lay audiences.

During the last year this project involved 182 elementary school students, 29 undergraduate students from UFSCar and 6 elementary school teachers. Tests applied to elementary school students showed that after the ACIEPE activities, at least 70-80% of the students are able to understand the basic idea and properly apply the scientific method

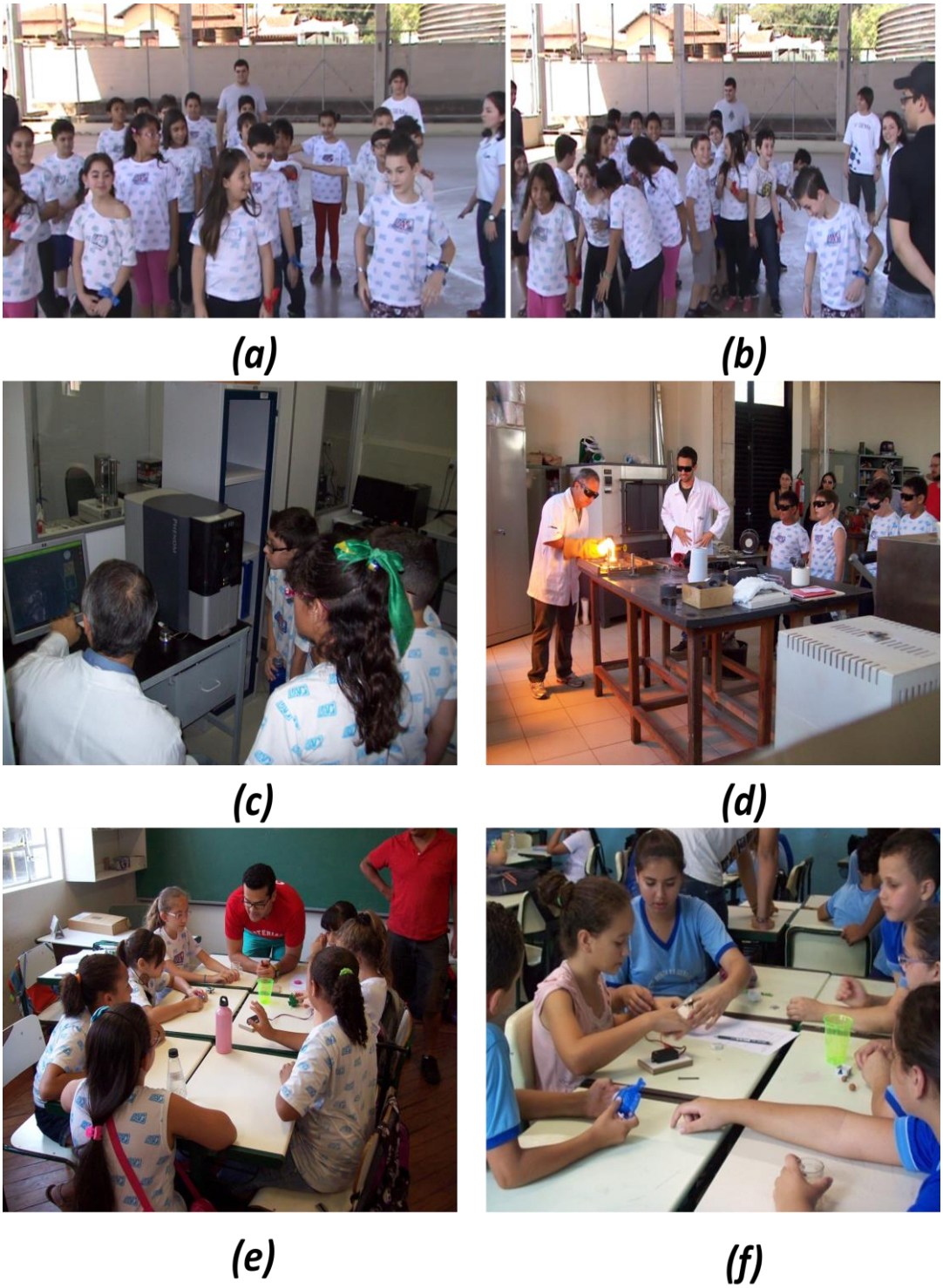

Figura 1 Activities of the project "Engineers and scientists of the future". (a) representation of a crystal structure using students as atoms, (b) representation of a glass structure after "fast cooling", (c) Electronic microscope demonstration for th the elementary school visit, (d) Glass production during the visit of the elementary school in the LaMaV laboratories, (c) and (d) activities in the classroom.

4.3.2. Other activities

4.3.2.1. “Comics”

The first volume of our “Mangá” (Comics) “Histories of glass” is ready, and has been given an ISSN number (ISSN 2359-6791). 2,000 copies were printed and will be distributed during the SBPC (Sociedade Brasileira para o Progresso da Ciencia - Brazilian Society for the Progress of Science) meeting, to be held in São Carlos in July 12-18. In this first volume, it is described, with simple and accessible words, “what is glass” and why is it interesting to study glass.

A second volume is already planned, about “glass recycling”.

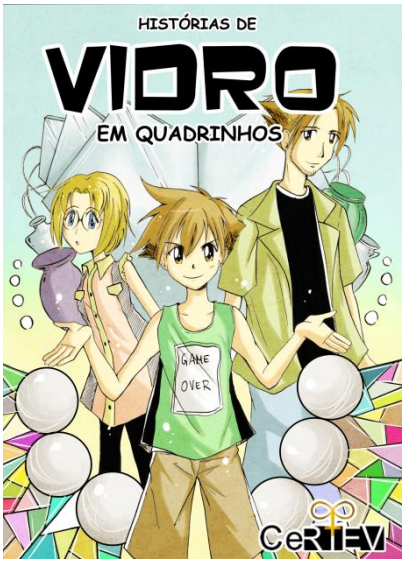

Figura 2 - First volume of our “Comics” on “What is a glass?”

4.3.2.2. Glass-Ceramics Course by Internet;

CeRTEV participated in the Glass Processing Course, organized by the International Materials Institute (IMI), New Functionalities of glasses, supported by the National Science Foundation http://www.lehigh.edu/imi/teched/GlassProcess/GlassProcessingSpr2015.html. Prof. Zanotto, head of CeRTEV gave two lectures on “Glass ceramics”. The first one had 43 attendants while the second had 71 attendants, a record for the IMI web-courses.

4.3.2.3. Advanced School on Glasses and Glass-Ceramics

CeRTEV is organizing the “Advanced School on Glasses and Glass-Ceramics”, to be held in São Carlos in August 1-9, 2015. This project, supported by FAPESP, selected 100 top-quality Masters and PhD students (50 Brazilians, and 50 foreigners from all over the world), with excellent CVs, who are currently doing research in the area of glasses and glass-ceramics. Selected students will have their international travel expenses to and from Brazil covered, as well as the hotel expenses, including breakfast, and lunch while in São Carlos, for nine nights.

The theoretical and experimental lectures will be taught by the most senior faculty of the CeRTEV as well as by several well-known, highly experienced international invited instructors. The classes will cover the fundamentals of *structure, relaxation processes, crystal nucleation, growth, overall crystallization, and properties (mechanical, electrical, optical and bio)* of glasses and glass-ceramics. The scheduled program may be seen below:

Saturday (08/01/2015)
08h00-12h15: Arrival of instructors and attendees of the G & GC São Carlos.
12h15-13h45: Lunch
13h45-15h45: Registration and distribution of badges and materials.
15h45-16h00: Coffe-break
16h00-18h00: Opening of the G & GC School.

Sunday (08/02/2015)
08h00-12h15: Time zone adaptation and preparation of the fire presentations
11h15-12h15: ICG structure and activities
12h15-13h45: Lunch
13h45-15h45: "Fire Session" 1 slide, 1 min. oral advertisement of posters by the students.
15h45-16h00: Coffe-break
16h00-18h00: "Fire Session" 1 slide, 1 min. oral advertisement of posters.

Monday (08/03/2015)
08h00-10h00: "Glass structure by NMR techniques" Prof. Hellmut Eckert, Brazil .
10h00-10h15: Coffe-break
10h15-12h15: "Glass structure by Raman spectroscopy" Prof. Paulo S. Pizani, Brazil
12h15-13h45: Lunch
13h45-15h45: Tutored discussion of student projects.
15h45-16h00: Coffe-break
16h00-18h00: "SciGlass - software and database" Dr. Alexander Priven, Korea

Tuesday (08/04/2015)
08h00-10h00: "Structural and stress relaxation in glasses" Prof. Prabhat Gupta, USA.
10h00-10h15: Coffe-break
10h15-12h15: "Dynamic processes in glasses by MD simulations" Prof. José Pedro Rino, Brazil.
12h15-13h45: Lunch
13h45-15h45: "Nucleation, growth and crystallization of glasses" Prof. Edgar Dutra Zanotto, Brazil
15h45-16h00: Coffe-break
16h00-18h00: Practical "Using SciGlass: Case Studies" Dr. Alexander Priven, Korea.
Wednesday (08/05/2015)
08h00-12h15: Visits to laboratories - UFSCar Lecture followed by a guided tour: Departments of Physics, Materials Engineering, LCE and LaMaV.
12h15-13h45: Lunch
13h45-18h00: Visits to laboratories - USP, São Carlos Lecture followed by a guided tour: Institute of Physics and School of Engineering .
Thursday (08/06/2015)
08h00-10h00: "Mechanical properties of glasses" Prof. Vincenzo M. Sglavo, Italy
10h00-10h15: Coffe-break
10h15-12h15: "Mechanical properties of glass-ceramics" Prof. Francisco C. Serbena, Brazil;
12h15-13h45: Lunch
13h45-15h45: Practical "Using SciGlass: Case Studies" Dr. Alexander Priven, Korea
15h45-16h00: Coffe-break
16h00-18h00: Presentation of 100 posters by the students

Friday (08/07/2015)
08h00-10h00: "Electrical properties of vitreous materials" Prof. Aswini Ghosh, India
10h00-10h15: Coffe-break
10h15-12h15: "Optical properties of Vitreous materials" Prof. John M. Ballato, USA
12h15-13h45: Lunch
13h45-15h45: "Spectroscopic techniques applied to glasses and glass-ceramics" Profa. Andrea A.S.S. de Camargo, Brazil
15h45-16h00: Coffe-break.

16h00-18h00: Tutored discussion of student projects.

Saturday (08/08/2015)
08h00-10h00: "Bioactive glasses and glass-ceramics" Dr. Steve Jung USA
10h00-10h15: Coffe-break
10h15-12h15: "Research opportunities in glasses and glass-ceramics in São Carlos
12h15-13h45: Lunch
13h45-14h45: Space for FAPESP
14h45-15h45: Working on students projects
15h45-16h00: Coffe-break.
16h00-18h00: Free .

Sunday (08/09/2015)
08h00-10h00: Student presentations of the projects
10h00-10h15: Coffe-break
10h15-12h15: Student presentations of the projects
12h15-13h45: Lunch
13h45-15h45: Departure to the airport in São Paulo

4.3.2.4. "**Science on stage**"

In association with the group "Ouroboros" for science communication, we have organized the event **"Science on stage VIII: science and art meeting"** in São Carlos from August 6th to 10th, 2014. This event brought together thirteen groups, from Brazil and Portugal, specialized in the art of science dissemination through theater. During the four days of this event, one hundred and sixty people participated in the planned workshops ("*oficinas")* and attended the plays presented by the scientific theater groups.

On the first day Ouroboros presented a Science and Art performance with circus and projection images and organized the Science and Art exposition with 12 micrographs of "Crystals in Glass" that was exhibited during the entire event.

A magazine was produced by Rui Sintra's equip and was publicized in internet to wild access http://www.sciencecomunicacao.com.br/uploads/files/revistacienciaemcena.pdf.

4.3.2.5. X Circus of Science

The Ouroboros group performed the Science and Art play to the public of the Open University Day in the Xth Circus of Science event that happened during September 22th and 23th. 2014. An exposition with vitreous materials was also held, including optical fiber, colored glasses, "glass piano" (sound made with different partially filled glasses of water), comics, videos, theater to an average of 1,000 attendants of primary and secondary school.

4.3.2.6. Workshop

CeRTEV had organised the Workshop: Ouroboros 10 years, at December, 12th at the Chez Marcel restaurant in São Carlos. During the event, which joined 60 people, the exposition "Masks of diversity" with 30 life cast models of the Ouroboros participants, was presented. The Ouroboros group is an association of professional citizens aiming at publicizing science for develops a critical citizen. A lecture entitled "Ouroboros 10 years" publicizing science and art was administered by Karina Lupetti, the Ouroboros director. A Stand up: "If my walking stick could talk" was performed by Olhares Group.

4.3.2.7. Educare

CeRTEV, together with the Ouroros group, organized a tour to science museums in São Carlos (CDCC, TAM) between 22th and 24th January, 2015 The event, which was called "Educare: science, art and education for kids" was attended by twenty children from 4 to 12 years old. Besides these

visits, activities involving games, drawing, and storytelling were carried on at the Educare site, near UFSCar.

Figura 3 - Comics: Stories of glass

4.3.2.8. - Inclusive Science and Art Exposition

The Science and Art photographic exhibition was planned to be organized with 3D printed models to promote accessibility to visually impaired or blind people. The manipulation of printed crystals could help to imagine the shapes visualized in the corresponding photography. We produced 12 models based on 12 micrographs with the help of a graphical designer. The artistic results will be presented at 67th SBPC annual meeting in São Carlos from July 13th to 18th 2015.

Figura 4 - 3D model of a crystal in glass, taken from the photograph series "Science and Art: crystals in glass"

Figura 5 - Visually impaired person manipulating the model and checking the 3D printer

4.3.2.9. ACIEPE: Comics to publicize Chemistry

During the 60 hours course to undergraduate students of USP and UFSCar, different views and information about glass were presented. Among the 15 proposed activities, tours to LaMaV laboratory and the glass repair room in the Chemistry Department taught the students some knowledge on glass science. One of the results of this course has glass as its theme, as we can see on Figure 5.

Figura 6 - Comics presenting some glass properties in a humorous way.

5. INNOVATION AND TECH TRANSFER

Eduardo Bellini Ferreira – EESC/USP (Coordinator)
Edgar Dutra Zanotto – DEMa/UFSCar
Oscar Peitl – DEMa/UFSCar
Paulo Sérgio Pizani – DF/UFSCar
Sergio Luis da Silva – UFSCar (Tech Transfer Manager)

Summary of the Tech-Transfer plan

CeRTEV's research achievements are channeled into innovation, all the way from new technologies and patents, to new products and processes ("science to business approach"). Promising new technologies are expected in the main fields of the CeRTEV's agenda of the following application fields: 1) strong GCs for armors and dental implants, 2) bioactive materials for bone and tissue restoration, 3) energy storage and conversion systems, 4) photonic devices, and 5) catalysts for converting biomass into fuels and chemicals. In all these fields we vigorously pursue transferring fundamental and applied research activities to the productive sector.

Our strategy for technology transfer is based on three basic pillars: ***i) establishment of cooperation agreements and licensing of on-demand technologies commissioned by industry***– the widespread skills of our group are in focus to bring the industry close to our academic institutions, connecting universities, companies and other institutions through cooperation programs as PITE and PPP/FAPESP, and FINEP; ***ii) nucleation of spin-off companies from the group activities***– entrepreneurship is stimulated, encouraging engagement in programs such as PIPE/FAPESP; and ***iii) extensive promotion of innovation and technology transfer***– accomplished by our extensive know-how in these subject areas combined with the assistance of agencies at UFSCar (www.inovacao.ufscar.br) and USP (www.inovacao.usp.br).

We aim at developing new or improved glass and glass-ceramics in each field of the applications mentioned above, e.g.: 1) light armors (for airplanes, cars and individuals) and tougher monolithic glass-ceramics for dental restoration; 2) macroporous and hierarchically ordered scaffolds, fibers, small monolithic parts and powders with increased osteoinductive activities, combined with the ability for targeted drug delivery for bone and tissue repair; 3) fast-conducting solid electrolytes for lithium ion batteries and new glass-ceramic seals for fuel cell applications; 4) solid state lasing materials with enhanced emission characteristics, and 5) an entirely novel application of macroporous and hierarchically structured glass-ceramics for conversion of biomass into fuel and fine chemicals. Industrial partners will be approached in concert with the research advances made in each area.

The technological core of our group is working to establish infrastructure for the production of prototypes, on a scale beyond the lab, bringing our activities as close as possible to the productive sector. For this purpose, one melting furnace for larger glass volumes than the conventional lab scale (some kilograms instead of grams) and one disc mill that can be continuously operated for a high throughput of glass powders were acquired and are going to be installed. A lab spray dryer for conditioning powders into granules with suitable properties for a fine powder processing will also be acquired.

In view of the goal to ensure efficient cooperation between academia and industry, it is crucial to increase the exposure of our students and postdoctoral fellows to the R&D environment in the industrial sector, significantly beyond the current practice in national postgraduate programs. To this end, we will establish a new fellowship program with the explicit purpose of enabling students to conduct part of their master and doctoral projects in the laboratories of our industrial partners. The costs of these fellowships will be shared between both parties. When it is necessary, we will work on adjusting the current postgraduate rules at our home universities to facilitate the establishment of this program.

An agenda of specially designed workshops will be established to guide CeRTEV members and collaborators in responding to manifestations of interests from industries and in developing some of their research activities towards innovation, to follow the patent literature, to gain access to patents and market reports, to estimate production costs and to identify potential markets for a given technology, to avoid publications prior to patent filing, and other important issues. The relevant information will be systematized and made available in the CeRTEV homepage in the Internet.

The discussion list in the Internet denominated "*Vidros*" was created in 1997 by E.B. Ferreira (Coordinator of Tech Transfer). Formerly, vidros@listas.ufscar.br was hosted at UFSCar's General Secretariat for Information (Sin). In the 2013-2014 period of CeRTEV activities it was brought to a more modern and attractive virtual environment, called "*listavidros*" at https://groups.google.com, e-mail address listavidros@googlegroups.com. Active people in the field of vitreous materials are invited to join and participate, stimulating the relations and R&D activities between academia and industry.

Finally, we aim to create an office to gather and make contact among CeRTEV's members, the glass industry and other institutes to access industrial problems and create demand for R&D in Brazil in traditional and new glass and glass-ceramic materials, including design, production and applications.

Overview of former achievements and last-year results

Establishment of cooperation agreements and licensing of on-demand technologies commissioned by industry

Summary of former actions (2013-2014)

In the period 2013-2014, several actions were taken to establish cooperation agreements and licensing of technologies commissioned by industry and/or developed by CeRTEV team: E.D. Zanotto (CeRTEV Coordinator) established Non-Disclosure Agreements (NDA) with the following companies with glass-based products, whose importance is measured worldwide: Ivoclar Vivadent (Liechtenstein), AGY (EUA), Owens-Illinois Glass (USA), and DMC (Brazil). Contracts for technology development were signed between members of CeRTEV team, UFSCar and the Aerospace Technical Center (CTA), a division of Brazilian Aeronautics, for "developing of glass-ceramic armors". H. Eckert (CeRTEV Vice-Coordinator) also established NDA with top glass companies: Schott (Germany), Corning (EUA), Nippon Electric Glass (Japan) and Ivoclar Vivadent.

In 2013-2014, E. D. Zanotto was consulted by a company from Murano, Italy, on the choice of São Carlos for a manufacturing plant of the traditional artistic glass. The company considered installing a Murano glass factory, the first abroad, in the State of São Paulo, and São Carlos was a strong player due to its universities and facilities in the glass field. Unfortunately since then we have not heard further news about this project yet, probably due to the uncertainties related to the current economic scenario of this country.

E.B. Ferreira supervised a master project (Raúl Revelo Tobar) on "recycling glass from CRT monitors into glazes for ceramic tiles", accomplished in partnership with Ceramic Center of Brazil (CCB), which specializes in the characterization and specification of ceramic tiles under standard practices. This effort was a stepping stone in building up a relationship with industries of the Ceramic Tile Pole of Santa Gertrudes (about 70 km from São Carlos), which is one of the largest of its kind worldwide. The project was completed in September 2014, and we are currently awaiting further requests for collaboration. As these industries command only rudimentary knowledge on glass technology, we expect a longer-than-usual induction period for establishing a partnership..

Further actions for the establishment of cooperation agreements will be considered in accordance with the research advances made in each area. We will work closely with some companies, such as Vitrovita and EDG (both at São Carlos), for bioglasses and glass-ceramics. Lithium ion cells in which glass and GC electrolytes are being implemented will be developed in São Carlos and tested

in collaboration with the Münster Electrochemical Energy Technology center in Germany, a joint academic and industrial platform dedicated to the development of high-energy and high-power lithium ion batteries. Brazilian giant Petrobras is interested in seals for fuel cell applications. The properties and performance of catalysts will be tested in collaboration with colleagues at the Brazilian Laboratory of Bioethanol Science and Technology (CTBE) and the Brazilian Laboratory of Synchrotron Light (LNLS).

Actions for establishment of cooperation agreements and licensing of on-demand technologies commissioned by industry in 2014-2015

E. D. Zanotto had new NDA signed with Owens-Illinois Glass (USA) for "development of strong glass bottles" and with IVOCLAR for "dental glass-ceramics". E. D. Zanotto also had approved a grant from Nippon Sheet Glass for "which equation best describes the equilibrium viscosity of oxide glass-forming liquids". H. Eckert has on-going research collaborations with Corning on "more fundamental structural research by NMR, regarding the mixed glass formers effect", and Nippon Electric Glasson "structural parameters influencing the crack resistance of magnesium aluminum-borosilicate glasses".

New negotiations have started with other industrial glass companies: E.B. Ferreira started negotiation with Rhodia (Brazil) for "using biomass for the production of glass"; M. Nalin started negotiation with the glass company SGD for "the relationship between optical properties and process s variables in the manufacture of glass"; and H. Eckert negotiates with the Brazilian glass company Electroglass for "a methodology for characterizing the structural origins of mechanical stability upon thermal shock".

Nucleation of spin-off companies from the group activities

In August2014 the first spin-off company from CeRTEV, VETRA High-Tech Ceramic Products was established in São Carlos by three CERTEV researchers, based on their doctoral and post-doctoral research achievements. The micro enterprise aims to offer solutions for different market segments by developing glass and GC materials that combine unique features such as biodegradability, bioactivity and bactericidal properties for bio applications. VETRA already requested the licensing of new two patents (mentioned below), both from CeRTEV's research effort, for which the announcement due out soon. A project of **Innovative Research in Small Business** (PIPE/ FAPESP) is being designed, under the supervision of E. D. Zanotto.

Extensive promotion of innovation and technology transfer

Summary of former actions (2013-2014)

- August 13, 2013: a team of CeRTEV researchers attended a meeting with Eduardo Brito, Administrative Analyst, and Freid Artur, Innovation Agentat USP Agency for Innovation, during the 5th Week US Pon Intellectual Property and Innovation. The following seminars were presented by E. Brito: (i) "*Legal Framework, Regulatory Framework and Incentives for Innovation*"; and (ii) "*University/Industry Partnership– Formalization, Benefits, Rights and Duties*". The presentations were accompanied by questions and answers on the specific demands of CeRTEV members.
- September 20, 2013: the Symposium "*The challenges of invention and innovation in Brazil: experiences of success and failure in the State of São Paulo*" was held at UFSCar São Carlos, sponsored by the Academy of Sciences of the State of Sao Paulo (Aciesp) and organized by E. D. Zanotto (Aciesp member and CeRTEV Coordinator). The speakers are recognized authorities in product development, processes, patents, interaction with companies, research and management of science and technology. The Symposium discussed the process of invention and innovation in universities and companies, and especially the experiences conducted in the State of São Paulo. The event was open to students, teachers, researchers, entrepreneurs, journalists and the interested public. Media exposure, e.g.:

http://agencia.fapesp.br/17876, and http://www.dci.com.br/sao-paulo/simposio-em-sao-carlos-discute-inovacao-id364282.html.

- Patents filed in the Brazilian National Institute of Industrial Property (INPI) include the following: BR 10 2013 017769 5 "*Glass-ceramic compositions, obtained glass-ceramic from the same, armor of sacrifice, and ballistic protection armor*" (in Portuguese), Titular UFSCar, Inventors L. Sant'Ana Gallo, A. C. M. Rodrigues, O. Peitl and E. D. Zanotto, June 26, 2013; BR 10 2013 020961 9 "*Glass composition, fiber and bioactive vitreous fabrics obtained from the same, and articles obtained by the same*" (in Portuguese), Titular UFSCar, Inventors E. D. Zanotto, M. T. Souza and O. Peitl, August 12, 2013; and BR 10 2014 003817 5 "*Discontinuous coating process using a bioabsorbable and bioactive biomaterial applied to solid substrates, the discontinuous coating obtained by same and the use of the discontinuous coating obtained by same*" (in Portuguese), Titular UFSCar, Inventors E. D. Zanotto, C. R. Chinaglia and O. Peitl, February 19, 2014.
- The discussion list in the Internet "*Vidros*" was brought to a more modern and attractive virtual environment, and denominated now "*listavidros*" at https://groups.google.com. Active people in the glass field are invited to join and participate, stimulating the -relationship and R&D activities between academia and industry. The list grew 60% up to 160 academic and industrial participants.
- April 2014: E. D. Zanotto received the award "Pawn of Technology" from the Technological Park Foundation of São Carlos (Parq Tec). Since 1993the titles awarded to people who have contributed through technological innovation to increase production, quality and competitiveness of products, processes and services in companies. Media exposure was wide, e.g.: http://agencia.fapesp.br/19052, http://sbpmat.org.br/professor-edgar-zanotto-recebe-o-titulo-de-peao-da-tecnologia-por-suas-acoes-em-prol-do-desenvolvimento-de-sao-carlos/, http://www.abc.org.br/article.php3?id_article=3330, http://sinc.com.br/pesquisadores-de-sao-carlos-sp-recebem-titulo-de-peao-da-tecnologia.html, andhttp://www.abividro.org.br/noticias/edgar-dutra-zanotto-recebe-o-titulo-de-peao-da-tecnologia.

Actions for promotion of innovation and technology transfers in 2014-2015

Portuguese Book on Glass Technology

It is a common sense there is a big gap between industry and academy in the field of glasses in Brazil, as in many other technologies. The largest companies installed in the country are mostly multinational with their head quarters and R&D labs abroad. The activities in this country are mainly focused on production and commercialization, attracted by a colossal internal market and the relative low costs of raw materials, manpower and production, and much less on development of new technologies and intellectual properties. We can observe this "mismatch" between academia and industry even for companies with domestic capital, which look abroad for the technologies they demand, transferring to foreign countries the impact of their economic activities. This is true to an even larger extent in the field of high-tech glass-ceramics. After many years of experience on higher education of our CeRTEV team, we have clearly identified the current deficits of affordable technical information in the field as one of the main barriers to break this vicious cycle of underdevelopment, which translates to a large extent in lack of specialized literature in Portuguese. For CeRTEV 2nd year, we planned start writing and make accessible in Portuguese a book on Glass Technology, targeting the workers in industry and students in the field as the main audience. We had identified several specialists on aspects of the glass production in Brazil, with solid experiences in the glass industry, willing to collaborate in this challenge. To this end, we rely on the important partnership with Dr. Mauro Akerman, who has 30 years of industrial experience at Saint Gobain Glass in Brazil as an internal consultant in the area of glass processing and management of technical training programs, now retired. Since 2008 M. Akerman has served as an independent consultant in the area; besides, he is coordinator of the School of Glass associated with ABIVDRO; and coordinator of the technical committee of ABIVIDRO. The project of a Portuguese Book on Glass Technology was, however, delayed in the last year due to the involvement of most people (mainly M. Akerman) in the project of

the technical course on glass technology detailed in the Education and Outreach Section. We will return to this project in the next year.

Meetings with industrial and laboratories partners

The project of a technical course on glass technology, well detailed in the Education and Outreach Section, will serve as a powerful tool for approaching potential industrial partners.We pursued the following agenda of meetings and visits to production plants and labs:

- Cebrace (Jacareí) – glass float + coating(sputtering)lines
- Pilkington (Caçapava) – thermally toughened and laminating lines of car windows
- Nadir Figueiredo (Itaquaquecetuba) – tableware production line
- Verallia (São Paulo) – Food packaging production line(bottles) and the glass laboratory of the Technical Center for Glass Elaboration (CETEV)
- Speed temper (São Roque) – toughened and laminating lines of glass for building construction
- UFSCar (São Carlos)–Materials Characterization and Development Center (CCDM) and Vitreous Materials Laboratory (LaMaV)
- CETEA/ITAL (Campinas) – packaging test laboratory
- Atelier Pierre Frisch (Santa Isabel) – handmade glass, handcraft glassware
- FATEC (São Paulo) –characterization of vitreous materials laboratory
- Verallia (Porto Ferreira) – training center
- Wheaton (São Bernardo do Campo)– production line of pharmaceutical and cosmetic bottles and operational training center
- **ABIVIDRO (São Paulo) –** Brazilian Technical Association of Glass Automatic Industries
-

CeRTEV meeting with the International Advisory Board

E.B Ferreira presented the CeRTEV Technology Transfer Program for the International Advisory Board during the X Brazilian Symposium on Glass and Related Materials (X-BraSGlass), held in São Carlos from 26 to 30 October, 2014.

The main suggestions from the IAB members and related with Tech Transfer were:

- CeRTEV should establish an industrial affiliate's network with an open to visitors day
- Increase interaction with the "innovation offices" of the three Universities
- CeRTEV students should be motivated to start *spin off* companies
- Work more closely with the CeRTEV manager of technology & innovation
- CeRTEV faculty and students should interact more with Brazilian industries, e.g.: catalytic supports, construction materials, armor materials, bio materials.
- Should try to solve relevant Brazilian problems. Establish how the CeRTEV's activities or efforts are related with the local industry, not only traditionally related with glass, but also others where glass is not an issue at a first view (agriculture, food, nutrition, recycling, etc.)
- Make efforts to include more PhDs into Brazilian industry
- Should clearly define mission statements
- Advertise the CeRTEV students (its main product) to industry
- Look not only into the glass industry, but also in the whole industrial chain for opportunities on glass technology
- Glasses in devices? Look for interesting problems related to applications of glasses (not only glass production)

- Provide characterization and testing services to industry; *spin off* on glass characterization?

Some of the suggestions above already are topics of the CeRTEV Tech Transfer Program and are being accomplished. The others will be taken into account in due time.

Patents filed

The following patents were filed in the Brazilian National Institute of Industrial Property (INPI) by some of CeRTEV researchers, as solid results of their scientific and technological efforts in the main fields of interest of our CEPID.

BR 10 2014 032548 4 "*Tubular conduit based on bioactive and bioresorbable glass fibers for regeneration of peripheral nerve tissue and process of obtaining the same*" (in Portuguese); Titular: UFSCar; Inventors: E.D. Zanotto, M.T.Souza, O. Peitl. Filing date: December 23, 2014.

BR 10 2014 023349 0 "*Device and method for obtaining fibers by downdrawing of compositions with low glass stability*" (in Portuguese); Titular: UFSCar; Inventors: E.D. Zanotto, M.T.Souza, O. Peitl. Filing date: September 19, 2014.

These patents are being analyzedat INPI

6th 3M Institute Award for University Students

The undergraduate student of Mechatronics Engineering Rubens Henrique de Carvalho Maria, supervised by E.B. Ferreira, CeRTEV Tech Transfer Coordinator, had his project of automatic machine to cut glass bottles and make sustainable glass cups (*Ecups*) qualified for the final of the 6th 3MInstitutefor University Students Award:http://www.unisol.org.br/2015/06/veja-os-finalistas-do-6o-premio-instituto-3m-para-estudantes-universitarios/The6th3MInstitute Award for University Students had a record of entries in 2015 –a total of 240submittedideas with the most diverse proposals, coming from all over the country. In the first round only 6ideas were selected, considering issues such as applicability, use of social technologies, innovation, sustainability, among other prominent criteria. In the next phase, which takes place from 1 to 2 July, classified students will participate in meetings at the Center Ruth Cardoso (Uni Sol head quarters), where they will receive professional guidance and technical training on the development of innovative business and presenting techniques. The winner will be announced on July 3 (after this report deadline), at a ceremony held at 3M, and receive financial and technical support for six months in the total amount of R$ 30,000.00. This money must be dedicated exclusively to the implementation of the idea.

6. INSTITUTIONAL SUPPORT

The CeRTEV has 7 faculty from UFSCar (including the center manager), 7 from USP - São Carlos campus, and 1 from UNESP - Araraquara campus. UFSCar and USP are located at about 3Km from each other and UNESP is approximately 30Km.

6.1. Institutional commitment UFSCar

The institutional support offered by UFSCar to our center has been quite substantial and helpful. A young faculty (Dr. Marcello R. B. Andreeta) was hired in 2013 by the Department of Materials Engineering - DEMa - and immediately joined the CeRTEV team. The Center Manager (Dr. Leandro Innocentini) is a professor of the Information and Scientometry department.

An administrative assistant, with a degree in administration (miss Ligia Diniz) was hired for by Vitreous Materials Lab of DEMa (CeRTEV´s headquarters). With the help of another assistant (Laurie Leonardo) she has been of tremendous help with the administration of the 14 faculty and about 50 students of the center.

Additionally, a new intern in computer science (Mr. Lucas Lima), was hired and spends 12 hours per week at LaMaV giving support to all computer maintenance and construction of the webpage (www.certev.ufscar.br)

Finally UFSCar research administration office has also been of great help with all the complex materials purchasing bureaucracy and especially importation of materials and equipment of the CeRTEV team.

UFSCar´s audio and teleconference facilities have also been offered to us and will be used starting next year.

6.2. Institutional commitment USP

Besides the USP institutional commitment already very much detailed in the CEPID first proposal, below we point the extra support which arose in respect of CeRTEV activities, or that guarantee to a large extent its activities.

Physical space

In January, 2014, the Group of Ceramics of the Department of Materials Engineering (SMM), EESC, moved from a lab of 40m^2 in the former SMM building at USP's Area 1 in São Carlos, shared with three principal investigators, to completely new facilities in the campus Area 2. The new ceramic lab now has 291m^2. The new SMMtotalsapproximately4, 500m^2, which includes the investigators' office and several labs of general purposes (user facilities): thermal analysis, chemistry laboratory, machine shop, thermal treatments, mechanical property characterization, sample preparation, optical and electrical microscopy, and x-ray diffraction, among others, besides the ceramic-specific labs. About US$ 3,120,000.00 has been spent in building, facilities and purchasing equipment, materials and costs, funded by University of São Paulo.

IFSC made 50m^2 of space available to house the new NMR spectrometer acquired by CeRTEV. Regarding the ESR lab, it had significant improvements done when the EPR machine was moved to its space. USP has provided funds for purchase of construction materials, electrical installation, internet network, materials and labor for building and facilities.

Research support at IFSC and EESC-USP

The Hybrid Materials Technology Center (CTMH/USP) is an interdisciplinary and multidisciplinary partnership for research, development and innovation in hybrid materials and materials interrelationships during fabrication processes, which joins the SMM/EESC with the Group of Crystal Growth and Ceramic Materials of the Physics Institute of São Carlos (IFSC). The CTMH started its activities in 2011 with an initial budget of US$ 500,000 for a Scanning Electron Microscope with Field Emission Gun (SEM/FEG) and EDS, and US$ 17,000.00 for materials and costs, funded by USP. These facilities are already available at EESC and running quite properly. USP is also responsible for the salary of the specialized technician responsible for operating the equipment.

Innovation support at EESC and IFSC-USP

The USP Agency for Innovation assisted us during the *CeRTEV Meeting in the 5th Week USP on Intellectual Property and Innovation*, detailed in the Tech Transfer Section of this Report. It also gave us support on the analysis of a research contract being formalized between the Itaipu Technological Park and EESC.

6.3. Institutional commitment of UNESP

The Chemistry Institute of UNESP in Araraquara has provided all the means necessary for the development of this project. Just after Prof. Marcelo Nalin's hiring and arrival in Araraquara (May 2013), the head of the Inorganic Chemistry Department and Dr. Sidney Ribeiro offered space in his laboratory to arrange all the equipment and to accommodate Dr. Nalin´s students. This laboratory, now shared with Prof. Ribeiro´s group, has around 200 m^2 with numerous facilities. Small adaptations of the local infrastructure were necessary concerning air conditioning, electricity panel, etc. to accommodate the equipment. The institute director also assumed the responsibility and offered all the necessary furniture for Dr. Nalin´s laboratory. In the Institute they have some multi-user equipment, to

which the Nalin group has total access. Therefore the support given to Nalin and his group has been quite substantial.

7. PLAN OF NEW ACTIVITIES FOR YEAR 3:

A top priority for CeRTEV's success will be the development of a coherent research programme aligning the activities of its individual members towards the common CeRTEV objectives. Towards this purpose numerous planning meetings have taken place during the past year, and joint activities are in full force. In the area of ***armor and dental glass-ceramics***, the possibility of monitoring nucleation and crystallinity via ^{7}Li-^{29}Si cross-polarization NMR will be built upon in an effort to study the nucleation process in its early stages. Our preliminary results indicate that ^{7}Li NMR relaxometry may be used in-situ for monitoring nucleation by direct observation; this will be explored on homogeneously nucleating Lithium diborate and lithium disilicate glasses. Another promising technique to be explored in detail is Raman spectroscopy, which will be conducted in parallel with the NMR studies done in an effort to relate the spectroscopic observables of both methods. Armed with these two powerful techniques and their potential synergy we expect to address some long-standing fundamental questions regarding the validity of the classical nucleation theory. In addition, the role of molecular dynamics simulations in studying nucleation processes will be enhanced, aiming at a deeper understanding of the nucleation kinetics in these systems. In the area of ***bioactive glasses*** fundamental questions regarding the structural role of magnesium oxide (network former versus network modifier) will be addressed, applying vibrational spectroscopy and NMR *in tandem* to some new promising magnesium borate containing compositions. With the recent installation of the new 600 MHz solid state NMR spectrometer we will be able to develop the potential of the low-gamma quadrupolar nucleus ^{25}Mg for probing the structural environment of magnesium ions in glasses in a direct fashion. Work in the ***solid electrolyte area*** will focus on correlating electrical conductivity measurements with dynamic observables (two- and three-time correlation functions) extracted from sophisticated multidimensional NMR experiments. While we are in the process of shifting our focus towards sodium-containing NASICON materials, we will also explore (oxy) chalcogenide glass composition forming superionic crystals upon ceramization. In the area of ***photonic materials***, we will build upon the very promising results obtained within the first year regarding the development of (a) new fluorophosphate glass compositions as solid hosts for rare-earth ion emitting laser materials, and proceed to the second step of preparing glass ceramics, based on rare-earth doped fluoride nanocrystals embedded in a glassy environment. We will further continue the work devoted to glasses containing uniformly-sized metal nanoparticle emitters. The ceramization processes will be monitored by NMR, EPR, and Raman spectroscopies. Finally, in the area of ***catalytic materials*** we will initiate a major push commencing with the production of hierarchically structured niobium and vanadium oxide materials, containing both meso- and macroporosity. In addition, we will create surface functionalized glass-ceramics with layers of suitable transition metal oxide and phosphate species. These materials will be characterized comprehensively in terms of their structural organization and subjected to suitable catalytic test reactions such as the cellulose - > hexamethyl furfural conversion. As such hierarchically structured materials are also very promising for osteoproductive and –inductive applications; we will also test them with respect to their interaction with simulated body fluid and osteoblastic cell cultures.

In summary, by the end of year 3 we expect to have developed the full range of activities in all of the areas delineated in the original CeRTEV proposal, and we anticipate to reap the first synergetic benefits obtained from results in the different application areas. We anticipate that as the result of our research efforts we will by then have various excellent glassy and glass-ceramic systems available whose technological application potential can be studied further in conjunction with our partners in industry.

ACTIVITIES PLANNED FOR NEXT YEAR - EDUCATION

Next semester, the municipality in which "The Glass Technology" course will be first offered, will already be defined. In accordance with this decision, all infrastructures for laboratories will be

developed. Also, we will start the training of teachers from Paula Souza Center, which will teach disciplines related to glass science in this course.

CeRTEV will participate in the 67th SBPC (Sociedade Brasileira para o Progresso da Ciencia - Brazilian Society for the Progress of Science) meeting, which has the title "Light, Science and Action" – in part dedicated to the "year of light") to be held in São Carlos in July 12-18. During this event, for which around 10.000 attendees per day are expected, CeRTEV will participate with a stand similar to the one which was presented in the "Circus of Science" showing some interesting aspects of glasses and glassy materials, and also an "Ouroboros" presentation for dissemination of Science through theater.

Basic Science Dissemination Activities

Aiming to diffuse the subject of glass science to a wide public, short stories of 1-5 minutes will be recorded and broadcast at UFSCar radio.

Banners describing some interesting "glass problems" have been created. In collaboration with Genoma's CEPID, these banners will be displayed in the subway system of São Paulo city, in order to reach the wide general public. Thousands of people circulate daily through the São Paulo subway. .

The science-art sketches of Ouroboros and Olhares Theater Groups (UFSCar) will be developed to be presented at different schools, universities, and events during the next year.

The Olhares Group is working on "Lucis est vita": the light seen by blind people that will be presented in SBPC congress next July. Ouroboros and Estação do Circo are working on "E= mc^2", talking about the science of motion and about the discoveries of prominent scientists such as Newton, Galileo and Einstein, combining circus elements and multimedia projections. Also, the Science and Art sketch of Ouroboros, which resulted in "VIII Science on Stage" will be presented on other special occasions, joining the beauty of circus and vitreous crystals.

A "World of Glass" exposition is planned and will be organized with videos, glass objects, banners, kits of experiments about glass and optical properties, as well as the science and art exhibition "3-D Crystal". This itinerant exposition will be sent to universities and other science education centers and institutes.

TECHNOLOGY DEVELOPMENT AND TRANSFER

We will continue on the path traced in our CEPID proposal for the technology transfer strategy during the 3rd year (2015-2016) of CeRTEV. In summary, the concepts and activities are detailed below, together with a plan of new activities for the next year when they are fit.

Establishment of cooperation agreements and licensing of on-demand technologies commissioned by industry

Several agreements between the CeRTEV team and companies with interest in glass and glass-ceramic technologies have already been formalized, as stated in the Tech Transfer Section of this report. Others are currently being negotiated or are on the way to be formalized. For the third year, we plan to consolidate the transfer of technologies based on scientific and technological researches accomplished by our team, and further develop our partnerships with these companies. The corresponding results will be documented in the form of new prototypes and filed patents. Technology licensing will be always pursued as a result of the agreements mentioned above.

Nucleation of spin-off companies from the group activities:

This is, of course, the most challenging task. Nevertheless, the first spin-off company from CeRTEV, VETRA High-Tech Ceramic Products, was established in São Carlos in 2014. A project of **Innovative Research in Small Business** (PIPE/ FAPESP) is being designed for this company, under the supervision of E. D. Zanotto. We will keep encouraging our researchers to pursue this kind of entrepreneurship.

Promotion of innovation and technology transfer:

We will continue our efforts to establish facilities for the production of prototypes, on a scale beyond the laboratory. As planned, one melting furnace for larger glass volumes than the conventional lab scale and one disc mill, which can be continuously operated for relatively large production of glass powders, have already been acquired at EESC/USP and started operating in this year. A lab spray dryer for conditioning powders into granules with suitable properties for fine ceramic processing is currently being acquired.

In a partnership with the UFSCar and USP Agencies for innovation, we will organize a workshop to stress to the group members and collaborators how to detect interests and manage some of their research to innovation, to follow the patent literature, to get access to patents and market reports, to estimate production costs and the potential market for a given technology, to avoid publications prior to patent request, and other important issues.

A CeRTEV workshop of Universities and Industries on Glasses is scheduled for September 11, 2015. In this workshop we aim at probing demands on glass science and technology from the national glass industry and other industries with interest on glass.

The discussion list in the Internet denominated *Vidros*, brought in the CeRTEV1styear to a more modern and attractive virtual environment at https://groups.google.com and listavidros@googlegroups.com, will be in focus aiming to increase the number of participants interested in glasses and glass-ceramics, in academy and industry. In the last year, it was planned a campaign to invite active people in the glass field to join and participate. This is going to be accomplished now, together with the effort to divulgate CeRTEV to the national glass industry, taking the opportunity of the Workshop CeRTEV of Universities and Industries on Glasses.

For the CeRTEV 2nd year, we planned to start writing and make accessible in Portuguese a book on Glass Technology, having the workers in industry and students in the field as the main target public. We had identified several specialists on aspects of the glass production in Brazil, with solid experiences in the glass industry, willing to collaborate in this challenge. For this we also rely on the important partnership with Dr. Mauro Akerman. The project of a Portuguese Book on Glass Technology was, however, delayed in the last year due to the involvement of most people (mainly M. Akerman) in the project of the technical course on glass technology detailed in the Education and Outreach Section. We will return to this project in the next year.

10. Descrição sucinta e justificada da aplicação dos recursos de Reserva Técnica e Benefícios Complementares no período coberto pelo Relatório (3 páginas).

Apresentação de seção específica para aplicação dos recursos de Reserva Técnica
Processo 2013/07793-6 - Prestação de Contas Parcial

MATERIAL PERMANENTE

Diego Gaspar Mendonça	Câmera	04/09/2014	Câmera fotográfica para registro de retração térmica em forno com campo elétrico, bem como demais registros de imagens de pesquisas diversas. Marca: Nikon, modelo: D5200, nº série: 2746691, com objetiva marca: Nikon, modelo: AF-S Nikon 18-55 mm, nº série: us20538390.	R$ 1.996,97
DHCP Informática	No-break	11/09/2014	Aquisição de no-break para instalação do novo equipamento de Infravermelho Transformada de Fourier	R$ 349,09
Cast Informática	Computador desktop	26/09/2014	Este computador está sendo utilizado pelos estudantes de doutorado que trabalham no laboratório de Ressonância Magnética do IFSC/USP em projetos atrelados ao Centro de Pesquisa, Inovação e Difusão CeRTEV (FAPESP Proc. 2013/07793-6). O computador contém um processador CPU Intel Core 3.2 GHz, um disco rígido 1TB, 8GB de memória, gabinete, teclado e um monitor de 23 polegadas. Este computador é adequado para processar os resultados dos estudos de espectroscopia de Ressonância Paramagnética Eletrônica (RPE) e elaboração de artigos e relatórios.	R$ 2.270,00

Amazon	Livro "Crystal Growth for Beginners"	29/09/2014	Livro para Pesquisa no Laboratório: "Crystal Growth for Beginners: Fundamentais of Nucleation, Crystal Growth, and Epitaxy". Descrição: Paperback: 546 pages, Publisher: World Scientific, 1 de jan de 2003, ISBN-13: 978-9812382450 ISBN-10: 9812382453 Edition: 2nd	R$ 450,23
Amazon	Livro "Functional Oxides"	29/09/2014	Aquisição do Livro para Pesquisa: Functional Oxides (Inorganic Materials Series), dos editores: Duncan W. Bruce, Dermot O'Hare e Richard I. Walton. ISBN: 978-0-470-99750-5 318 pages, July 2010	R$ 343,59
Romaq	Móveis	03/10/2014	Móveis e bancadas para organização de equipamentos e materiais de laboratório, bem como para trabalhos de rotina de pesquisa.	R$ 3.725,00
Marcelo Zampieri Ar Condicionado ME	Compressor Scroll Danfoos e Filtro de gas	03/10/2014	Recuperação do compressor do ar condicionado do laboratório de Física Computacional que queimou, mais a manutenção do mesmo, tais como, limpeza, lubrificação e complementação de gás refrigerante.	R$ 1.839,00
Infomais Computadores LTDA ME	Projetor EPSON	06/10/2014	Aquisição de equipamento multimídia para reuniões, visitas, seminários semanais (ensino-aprendizagem) e apresentações do LaMaV e CeRTEV. digital interativa e de recursos que podem auxiliar na criação de novas metodologias de ensino no âmbito escolar. Pode ser usado integrado a várias tecnologias.	R$ 2.630,30
Servitech	Agitador Mecânico	07/10/2014	Agitador para preparação de barbotinas para fabricação de esmaltes e vidrados cerâmicos, bem como demais suspensões cerâmicas. Marca: Servitech, modelo: CT-054, nº série: 240.	R$ 2.768,70
WMB comércio eletrônico ltda.	Impressora 3d cube verde	13/10/2014	Impressão de moldes 3D dos cristais de vidro para a Exposição Ciência e Arte Inclusiva. A Exposição Ciência e Arte são compostas por 12 fotografias/ micrografias de cristais vítreos. Estes foram modelados utilizando programa	R$ 2.998,00

			computacional e configurados para a impressão 3D de modo a torná-la inclusiva para pessoas com deficiência visual ou mesmo qualquer pessoa que participe da exposição.	
Dental São Lucas (I. de F. Z. Jacovozzi Aqa EPP)	Bamba vácuo eco 740 biomec 220V	24/10/2014	Bomba vácuo eco 740 biomec220V–Adquirida para auxiliar na síntese de nanopartículas magnéticas as quais são posteriormente incorporadas ás matrizes vítreas. Estes materiais são usados para estudos da interação de lasers de femetosegundo com as nanopartículasnano magnéticas dispersas nos vidros.	R$ 1.110,00
Recibo	Recibo referente ao ajuste a débito devido à variação cambial nas compras dos livros	07/11/2014	Devido à grande mudança do dólar, foi cobrada uma taxa de ajuste de cambio. Esta taxa refere-se às compras dos livros 'functional oxides' e 'crystal growth for beginners: fundamentals of nucleation, crystal grow and epitaxy, e dvd 'bioceramics' no mês de setembro de 2014	R$ 328,48
EDG - Equipamentos e Controles/Material Permanente	Forno Mufla	21/11/2014	O forno mufla foi necessário para preparar as amostras vítreas para nossa pesquisa	R$ 5.500,00
Amplimag controles eletronicos LTDA	Equipamento de alimentação ininterrupta de energia microprocessado	05/12/2014	Devido a inúmeras interrupções elétrica e o retorno de poder freqüentemente é acompanhado por uma grande "peak" de alta tensao, que poderia destruir equipamento eletrônico sensível. O equipamento comprado vai manter alimentação constante durante uma interrupção de poder elétrica e evitar "peaks".	R$ 32.100,00
PHD Sist de Energia Ind Com Imp e Exp LTDA	EA930 3K E220/S220 B19, CD proprio gravado, software p/ UPS	11/12/2014	Nobreak para equipamento de DSC devido a constantes variações de energia	R$ 3.055,00
S. F. áudio e vídeo e informática	Nobreak SMS, adaptador para tomada universal	13/12/2014	Nobreak para equipamento de pesquisa do LaMaV, para evitar o desligamento abrupto do dispositivo evitando danos.	R$ 628,60

Quimis	Ultrassom	16/12/2014	Equipamento de ultrassom para limpeza de amostras para análises diversas. Marca: Quimis, modelo: 03350, nº série: 14120538.	R$ 1.905,98
Perez Oxigênio	Cilindro ar sintético, regulador para ar	18/12/2014	Itens para controle de atmosfera com ar sintético e argônio para análises térmicas em um equipamento de DSC Netzsch F1 no SMM/EESC/USP. Cilindro marca: Air Products, modelo: JAG9-094-IIT, nº série: APBL 62680. Regulador marca USIMAFER (Perez Oxigênio), modelo: UMF833, nº série: 74192.	R$ 2.580,00
Labsynth	Balança analítica	19/12/2014	Balança para pesagem de amostras de pesquisa em geral. Marca: Shimadzu, modelo: AUX220, nº série: D305020360.	R$ 3.925,00
M&M computer	Multifuncional laser HP	22/12/2014	Impressora para documentos de pesquisa, trabalhos de pós-graduação e iniciação científica. Marca: HP, modelo: LaserJet Pro MFP M125a, nº série BRBSG9SQDG.	R$ 738,99
SF Áudio Vídeo e informática Imp e Exp LTDA	Notebook HP	07/01/2015	Notebook para pesquisa, apresentação de seminários e laboratório em visitas, notebook HP 14-d028br, Product f4H12LA#Ac4, PCID 097E100000405F10000610100	R$ 1.680,00
C&A computadores	Computador desktop	23/01/2015	O computador foi montado para suprir a necessidades de analisar dados de pesquisa, Processador: S/N 2L409156A2185, Estabilizador: 165200070537 e Placa Mãe: EBM0B4042498	R$ 1.543,88
Casas Bahia	Ventilador 40cm Mondial	23/01/2015	Ventilador para salas de fornos, para manter a sala em temperatura adequada para trabalho (evitar superaquecimento)	R$ 119,00
C&A computadores	Computador desktop	28/01/2015	Computador modelo Desctop com Processador Intel CORE I5 IVY BRIDGE 3.0 6M (I5 3330), Placa MB ASUS H61M-A LGA 1155, Memoria kigston ddr3 1333mhz, Gravador DVD LITE-ON BLACK SATA, HD 1.0TB SATA III HITACHI/SEA 7200 RPM, teclaro Brastech multimidia USB preto, fonte ATX 500W real one power/ solid 1*12-K, GABINETE WISE CASE C/FONTE (RJAC-	R$ 1.704,00

			618/401/402/40). Número de série CBWD0001CKN0660S	
Dell	Microcomputador portátil e windos 8.1	20/02/2015	Notebook para impressão dos moldes na impressora 3D, notebook Dell model: P49G type: P49G001 Dell Inspiron 14	R$ 2.399,50
M&M Computer	Impressora HP laserjet P1102W	11/03/2015	A impressora está sendo utilizada pelo próprio pesquisador e seus orientados no laboratório de Ressonância Magnética do IFSC/USP. Todos eles trabalham em projetos atrelados ao Centro de Pesquisa, Inovação e Difusão CeRTEV. A impressora selecionada foi a HP laser jet P1102W, que tem uma boa relação de custo benefício, permitindo a impressão dos resultados dos estudos de espectroscopia de Ressonância Paramagnética Eletrônica (RPE) e a impressão dos artigos e relatórios.	R$ 535,00
SF Áudio Vídeo e informática Imp e Exp LTDA	Filmadora sony hdr-cx240	21/03/2015	Câmera fotográfica/ filmadora para registro de amostras, eventos	R$ 939,90
Odeme Equipamentos médicos e odontológicos	Dispositivo teste de flexao biaxial	27/03/2015	Dispositivo de ensaio mecânico de amostras circulares e finas	R$ 1.345,00
Recibo	Livros "Making Glass Better" e "Electrical Properties of Glasses (free of costs)"	08/04/2015	Aquisição do livro: Making Glass Better, 2 edição, publicado em julho de 2014, 144 páginas ISS 978-84-8198-900-7 - Editores: Klaus Bange, Alicia Duran e John M. Parker, com esta compra ganhamos o livro: Electrical Properties of Glasses	R$ 158,83
Recibo	Compra de artigo	08/04/2015	Material para pesquisa Armour cermics ballistic effiency evaluation, ISBN 10 8886538022, 1995	R$ 164,88
Recibo	Reembolso compra livro The Eletronic Structure and	08/04/2015	Aquisição de material para pesquisa, livro: The Electronic Structure and Chemistry of Solids (Oxford Science Publications) Paperback – July 16, 1987	R$ 314,01

	Chemistry of Solids		Autor P. A. Cox. ISBN-13: 978-0198552048 ISBN-10: 0198552041 Edition: 1st	
EDG Equipamentos	Forno mufla f-3000 3P + exaustor venturi	13/04/2015	Este forno fabricado pela empresa EDG está sendo utilizado para a preparação de amostras pelos estudantes de doutorado que trabalham no laboratório de Ressonância Magnética do IFSC/USP, em projetos atrelados ao Centro de Pesquisa, Inovação e Difusão CeRTEV. O forno tem uma temperatura máxima de aquecimento de 1100 oC, tem três velocidades de aquecimento, um gabinete em aço inoxidável com porta basculante e com saída para exaustão de gases. Este forno é adequado para fundir os óxidos metálicos e preparar as amostras de vidro.	R$ 5.886,00
Aifos	Mesa para balança	22/04/2015	Mesa antivibratória para balanças de quatro casas	R$ 3.000,00
Dell	Microcomputador, teclado e mouse,autofalante,software macafee,windows	23/04/2015	Equipamento para sala de seminários: Model Number: DELL, XPS- 8700 series; número de série: H4T1542; Sistema operacional Windows 8 (64 bit); Processador: Intel Core i5-4460 (3.2 GHz); Optical Drive: DVD multi recorder; 8GB de memória ram e HDD: 1 TB	R$ 2.755,98
Infomais Computadores LTDA ME	Monitor led 19,5 Samsung	30/04/2015	Monitor Led, 19,5 Samsung, Número de série 411SPAEA6496, Resolução da tela: HD 1600 x 900, Entradas USB e HDMI	R$ 398,72
Diego gaspar mendonça	Câmera	04/09/2014	Câmera fotográfica para registro de retração térmica em forno com campo elétrico, bem como demais registros de imagens de pesquisas diversas. Marca: Nikon, modelo: D5200, nº série: 2746691, com objetiva marca: Nikon, modelo: AF-S Nikkor 18-55 mm, nº série: us20538390.	R$ 1.996,97
DHCP Informática	No-break	11/09/2014	Aquisição de no-break para instalação do novo equipamento de Infravermelho Transformada de Fourier	R$ 349,09

CONSUMO				
FORNECEDOR	**DESCRIÇÃO**	**DATA DE EMISSÃO**	**JUSTIFICATIVA**	**VALOR**
Widiamaq	Brocas e caixa de ferramentas	16/07/2014	Brocas e caixa de ferramentas para confecção de peças para fornos e uso em geral	R$ 2.078,49
Montes & Biancolli LTDA	Cartuchos e tonner	17/07/2014	Tonner para impressão de Material de Pesquisa do Laboratório LaMav	R$ 287,00
Thermo Global	Resistência Elétrica	17/07/2014	Material utilizado para confecção do sistema de aquecimento de reator	R$ 100,00
Abeneto Comercial de Ferragens Ltda	Alumínio e cobre	25/07/2014	Tarugos de metal para confecção de uma tampa e manutenção de um reator hidrotermal	R$ 81,00
Peronti Suplementos Industriais	Espigão, pino e engate	05/08/2014	Peças para montagem de linha de ar comprimido (compressor)	R$ 156,70
Miguel Materiais	Blukit registro esfera	06/08/2014	Registro de espera para linha de ar comprimido	R$ 19,00
AlvTech Informática	Mouse Óptico	07/08/2014	Mouses para substituição em computadores do Laboratório de Microscopia.	R$ 56,00
Peronti Suplementos Industriais	Roda lixa, disco e anel	08/08/2014	Dispositivo para lixamento e acabamento de peças e próteses confeccionadas no laboratório	R$ 112,21

Pepara Comércio de Metais Ltda	Aço inox	08/08/2014	Tubos de aço inox com diâmetro de 0,25mm para confecção de um dispositivo para controle de temperatura em um reator de síntese hidrotermal.	R$ 31,00
Pepara Comércio de Metais Ltda	Aço inox	08/08/2014	Tubos de aço inox com diâmetro de 0,25mm para confecção de um dispositivo para controle de temperatura em um reator de síntese hidrotermal.	R$ 31,00
Camir Parafusos	Broca, niple e graxa	14/08/2014	Brocas para confecção de peças para fornos e uso em geral; niples e graxa para manutenção da linha de ar e lubrificação de maquinas e equipamentos do laboratório, respectivamente	R$ 168,64
Wortec Compressores	Elementos coalescentes	20/08/2014	Elementos de substituição para os filtros de partículas de 1 e 0.1 micras, posicionados na estrada e saída do secador de adsorção, na linha de ar comprimido seco utilizada no espectrômetro de Ressonância Magnética Nuclear, para rotação das amostras em alta velocidade (experimentos de RMN de alta resolução.	R$ 1.803,00
Refrigás	Cola adesiva e manta esponjosa	21/08/2014	Materiais para manutenção e reparos de dispositivos diversos no laboratório, incluindo vedação de armários, jarros para moagem entre outros	R$ 257,50
Jabu	Ilumatic, lamp e lor me	25/08/2014	Lâmpadas e reatores para reposição do sistema de iluminação dos Laboratórios	R$ 164,64
Peronti Suplementos Industriais	Óculos runner, bico limpeza	26/08/2014	Materiais fundamentais para segurança dos pesquisadores, como: óculos de proteção para usinagem e/ou abertura de fornos e bico de limpeza, dispositivo que é acoplado em mangueira de compressor para efetuar remoção de pó e limpeza em geral	R$ 228,91
Nicsa	Elementos filtrantes	28/08/2014	Elemento de substituição de filtros de partículas de 1 micra, na entrada de ar seco no laboratório de RMN (espectrômetro).	R$ 257,04

DISAFE Comercial de Ferragens LTDA	Maçarico e gás butano	28/08/2014	Maçarico (incluindo gás butano para abastecimento) para manutenção de equipamentos em geral no laboratório, incluindo aquecimento, fundição e corte de metais.	R$ 74,60
Mundial Megastore	Bolsa e cartões de memória	29/08/2014	Bolsa para acondicionamento de câmera fotográfica utilizada para registro de retração térmica em forno com campo elétrico, bem como demais registros de imagens de pesquisa, e cartões de memória para armazenamento de imagens.	R$ 172,40
Multipack	Bobina picotada, detergente	29/08/2014	Bobina picotada para embalar e transportar amostras e materiais sólidos; detergente para limpeza / higienização em geral de equipamentos e vidrarias	R$ 779,45
Andrade & Leone Informática	Cartuchos, dvds, etc	03/09/2014	Tinta para impressão e DVDs para gravação de teses, dissertações, trabalhos de pós-graduação e pesquisas realizadas no Grupo de Engenharia de Materiais Vítreos (GEMaV) do SMM/EESC/USP.	R$ 50,80
DHCP Informática	Acess point wireless	05/09/2014	Aquisição de roteador para substituição de equipamento da rede wireless do laboratório	R$ 627,02
AMC - Hidráulica e Pneumática LTDA	Conexão PMM 06	15/09/2014	Conexão PMM 06 para manutenção de linha de ar comprimido	R$ 36,00
Bogas comércio e distribuidora De peças LTDA EPP	Regulador fluxo linha e conexão reta	16/09/2014	Conexão hidráulica para a refrigeração do eletromagneto do referido espectrômetro de RPE	R$ 11,99
Hygro-Therm Comercial e Técnica LTDA EPP	Medidor de vazão tipo rotâmetro	16/09/2014	Medidor de vazão tipo rotâmetro, onde o flutuador é suspenso pelo fluído a uma altura correspondente à vazão para controle de fluxo de gás (instalação do novo DSC)	R$ 1.426,20

De Santis Comercial LTDA	Escova de aço circular, kit Dremel e adaptador	18/09/2014	Ferramentas para acabamentos finais em cadinhos cerâmicos	R$ 158,00
Oxi-maq Com e Ind de Equipamentos LTDA	Discos flap, disco acabamento, rodas pg, regulador e escova rotativa	18/09/2014	Materiais para efetuar limpeza em matérias metálicos, usadas para moldes.	R$ 508,00
Ca and Ma Componentes Eletrônicos	Lupa de bancada	22/09/2014	Esta lupa é utilizada para observar e manipular pequenas amostras nos tubos porta-amostras específicos para a Espectroscopia de Ressonância Paramagnética Eletrônica(RPE). O aparelho contém uma lente e um sistema de iluminação formado por LED em torno da lente. Estas lupas de bancada, que são comumente encontradas nos laboratórios de pesquisa e em oficinas eletrônicas, são muito práticas e relativamente econômicas (R$ 243,10). A lupa fica posicionada numa bancada no Laboratório de Ressonância Paramagnética Eletrônica do Instituto de Física de São Carlos (USP).	R$ 243,10
Bogas Comércio e Dist de Peças	Kit de pinças, brocas, jogo escova de aço circular, rodas lixa	24/09/2014	Ferramentas para usinagem e acabamentos de moldes metálicos	R$ 90,28
American Ceramic Society	DVD "Biocermics"	29/09/2014	Aquisição de DVD para pesquisa: Bioceramics: Advances and Challenges for Affordable Healthcare Short Course, ACerS and Florida Institute of Technology Continuing Education fizeram uma parceria para oferecer uma série de quatro cursos de curta duração em bioceramics ensinados pelo Dr. Larry Hench. Sob medida para profissionais das áreas de engenharia e de saúde, os cursos destacar temas importantes que enfrentam os biocerâmica, materiais cerâmicos bioativos, e indústrias biovidro.	R$ 653,38
Circelli Rolamentos	Anel Oring 2112 Viton	30/09/2014	Anel oring para manutenção de reator para síntese hidrotermal	R$ 87,50

Ferbemar Industria e Comercio de Peças LTDA ME	dobradiças, canais, haste, roscas, suporte e porta amostras	01/10/2014	Elaboração de serviço de usinagem em suporte de micropipetas	R$ 1.515,00
Eletrônica Pinhé	Bateria LR-1130 e LR-44 1.5V	01/10/2014	Reposição de bateria de equipamentos como do laboratório	R$ 22,00
Camir Parafusos Ltda - EPP	Arr lisa inox, PF MQ, PF ST, PO ST, barra, PO ST e BORB	01/10/2014	Porcas, arruelas e parafusos em inox para construção de reator químico	R$ 89,14
Jabu	COEL R Tempo AEG SEG60	07/10/2014	Reposição de rele eletrônico para câmara climatizada (contrel e temperatura	R$ 55,02
Infomais Computadores LTDA ME	Switch hub e extensão	07/10/2014	Dispositivos para manutenção da rede de internet via cabo do laboratório.	R$ 60,00
Casa do serralheiro	Barra metalon, rodizios, chapa	07/10/2014	Itens para fabricação de prateleiras, mesas e racks de equipamentos de pesquisa, e organização do laboratório.	R$ 1.428,33
Alvtec Informática LTDA ME	"HD Externo 2,5" 1 tera Samsung	08/10/2014	Equipamento de informática utilizado para armazenar arquivos de pesquisa de medidas DSC	R$ 265,00
Camir parafusos	Macho man, pf st int inox, pf mq inox, arr lisa	13/10/2014	Material necessário para construção de reator químico.	R$ 239,49
Refrigás	Cola adesiva p/ tubo esponjoso e isopor	14/10/2014	Isolamento da torre de refrigeração do raio-x	R$ 104,70
WMB comércio eletrônico ltda	Cartucho de plástico pla cube branco-3d	14/10/2014	Cartuchos para a Impressão de moldes 3D dos cristais de vidro para a Exposição Ciência e Arte Inclusiva.	R$ 556,00

Aço Mix	Alumínio vergalhão	17/10/2014	Para produção de porta amostra par MEV	R$ 30,00
Oxi-maq Com e Ind de Equipamentos LTDA	Trenas, tinta spray, creme prot e eletrodo	17/10/2014	Materiais necessários para reparos de bancada	R$ 145,40
De Santis Comercio de Materiais para construção LTDA	Tubo esgoto	18/10/2014	Tubos de PVC para fabricação de moldes de gesso e dispositivos de peneira de laboratório.	R$ 92,30
Alvtec Informática	Teclado usb frotrek	21/10/2014	Material de consumo utilizado em computador para pesquisa.	R$ 22,00
Casa do serralheiro	Barra metalon e cantoneirinha	22/10/2014	Itens para fabricação de prateleiras, mesas e racks de equipamentos de pesquisa, e organização do laboratório.	R$ 1.113,80
Marcelo Honorato Marleta (M&M)	HD (interno)	24/10/2014	Substituição de equipamento do computador de pesquisa, necessário para o bom funcionamento e armazenamento de informações	R$ 699,80
Informatica e cia	Baterias e toners	27/10/2014	Materiais para impressão de materiais de pesquisa e baterias para equipamentos de pesquisa	R$ 1.280,00
Marketsandmarkets	Livro "Global Bioactive Material mkt 2014-2018"	07/11/2014	Material de pesquisa sobre estudos de mercados, pesquisa desenvolvida por analistas - TechNavio's - abrangendo os cenarios atuais com perspectivas de crescimento. Este conhecimento é fundamental para guiar as linhas pesquisas, visando melhor aproveitameto dos estudos e visão de mercado	R$ 6.726,14
MM Comercial	Rometal kit porta, trilhos mundial	14/11/2014	Itens para fabricação de armários de laboratório, Laboratório de Vidros do SMM/EESC/USP.	R$ 281,40
Marcelo Honorato Marleta (M&M)	Baterias e toners	19/11/2014	Materiais para impressão de materiais de pesquisa e baterias para equipamentos elétricos do departamento de física	R$ 1.690,00

Bogas	Mini 500KG e pino 3 saídas	19/11/2014	Vibra-Stop para rack do forno de fusão de vidros grande e tomada para instalação elétrica.	R$ 112,50
Montes & Biancolli LTDA	Toner para hp q5949A e hp cb436	20/11/2014	Cartuchos para impresso HP q5949A e HP cb436 para computadores LaMaV	R$ 360,00
EDG - Equipamentos e Controles/Material de Consumo	Placa Refrataria com Resistência	21/11/2014	Esta placa precisávamos comprar para consertar um forno mufla quebrado.	R$ 1.500,00
Cabos Fron Com de Conect rede e eletron.	Conversor de 1 port USB para 1 porta paralela	24/11/2014	Cabo de conversão do equipamento politriz, era necessário uma porta USB e uma porta para impressora com a finalidade de arquivar e imprimir os resultados obtidos.	R$ 122,00
S.A. Rocha e Rojo LTDA	Compensado sumauma 15mm 160x220	25/11/2014	Material utilizado para confecção de caixa para armazenamento e organização dos moldes 3D dos cristais de vidro para a Exposição Ciência e Arte Inclusiva.	R$ 112,00
Spectris do Brasil instrumentos eletronicos	Sonda RTD de uso geral~PR-11-12-100-1/8-12-E	04/12/2014	Aquisição de termopar para controle de temperatura em fornos durante a realização de tratamento térmicos.	R$ 372,00
Rogerio Perroni Castaldi ME	Tubo inox e tubo alumínio	10/12/2014	Material para confecção de parte de linha de gás	R$ 35,00
DHCP informatica	HD Externo 2,5" USB 3.0 1TB Western Digital	11/12/2014	Equipamento para armazenamento de acervo de pesquisa e análises do LaMav	R$ 252,57
S.F. áudio e vídeo e informatica	Tonners	11/12/2014	Os toners são indispensáveis para garantir a impressão de artigos científicos e demais documentos referentes a pesquisa.	R$ 1.758,71

Rogerio Perroni Castaldi ME	Latão sext 5/16x1500 e 3/8/1500	12/12/2014	Confecção de parafusos de latão	R$ 67,00
MM Comercial	Fechaduras 3F 3021	15/12/2014	Fechaduras para instalação em armários de laboratório, Laboratório de Vidros do SMM/EESC/USP.	R$ 129,60
A Nacional artigos para tapeçaria em geral	Veludo para polimento	15/12/2014	Material utilizado para Polimento de amostras	R$ 75,00
Bogas parafusos	Dobradiça ferro, PF RM FE SIMPLES, porca sext	15/12/2014	Material utilizado para confecção de caixa para armazenamento e organização dos moldes 3D dos cristais de vidro para a Exposição Ciência e Arte Inclusiva.	R$ 4,54
Perez Oxigênio	Tubos e conexões para ar sintético	18/12/2014	Itens para instalação de dispositivo para controle de atmosfera com ar sintético e argônio para análises térmicas em um equipamento de DSC Netzsch F1 no SMM/EESC/USP.	R$ 50,00
Bogas Parafusos	Arruela, broca, pf em, porca	06/01/2015	Itens para instalação e fixação de um destilador de água na parede do laboratório de cerâmicas do SMM/EESC/USP.	R$ 26,10
MM Comercial	Fecho rápido e puxador união tubular	08/01/2015	Materiais para acabamento da caixa confeccionada para armazenamentos dos moldes 3D dos cristais de vidro para a Exposição Ciência e Arte Inclusiva.	R$ 73,20
Bogas Parafusos	Ponteira pvc interna rígida	12/01/2015	Acabamento de pés de prateleiras e mesas fabricadas em aço para organização e bancadas de equipamentos de laboratório.	R$ 32,19
Pinhé	Cabo silicone, cabo pp	12/01/2015	Terminais para forno de tratamento térmico	R$ 35,00
Eletrônica Pinhé	Bateria 9V alcalina	13/01/2015	Baterias para termômetro digital de laboratório, utilizado para monitorar a temperatura de tratamentos térmicos por longos tempos (várias horas).	R$ 12,80

Pinhé	Bat sel 12V 7AH, conector latch, flat cable cinza	17/01/2015	Substituição de Baterias para no-break e cabo multi vias	R$ 72,00
Eletrônica Pinhé	Fita, pilha, bateria, etc.	20/01/2015	Materiais para manutenção em dispositivos eletrônicos do Laboratório	R$ 219,00
Peronti	Conector, conexao T, cruzeta, válvula, bucha, etc	28/01/2015	materiais necessários para instalação de linha de gás do equipamento DSC / termo balança	R$ 324,65
Aço Mix	Alumínio vergalhão, chapa poliacetal	28/01/2015	materiais para suporte para amostras de amostras biológicas	R$ 110,00
Aço Mix	Tubo inox, alumínio	30/01/2015	Material para confecção de parte de linha de gás	R$ 89,00
Paschoal e Santos Marmoraria	Tampo de mesa em granito verde ubatuba e 1 cinza andorinha	02/02/2015	Placas de granito para tampo de mesas utilizadas como bancadas de laboratório.	R$ 1.252,72
Jabu	STE New ACOPL N4056 16A 3P+T VM	03/02/2015	Plug necessário para adaptação de equipamento do laboratório.	R$ 24,56
Informática e Cia	Fonte nt universal manhattan, web cam	03/02/2015	Equipamentos necessários para aulas e apresentações online	R$ 189,00
Jabu	Cabo flex, croma bem, fita isolante	04/02/2015	Confecção de extensão elétrica	R$ 108,88
White Martins Gases	Gás Helio	05/02/2015	Compra de He líquido para energização do magneto supercondutor do espectrômetro de Ressonância Magnética Nuclear de 600MHz, adquirido com verba do projeto CEPID.	R$ 34.999,99
Eletro eletrônica	Lâmpada led, carregador,	06/02/2015	Itens para montagem de sistema de iluminação para uso em forno com campo elétrico. Baterias recarregáveis e carregador para termômetro digital de	R$ 213,00

Gaspar	bateria, bocal e filtro		laboratório.	
Gualtieri comercial ltda.	Veda rosca, válvula esfera, conector e te cobre	09/02/2015	Elementos par a linha de recuperação de He gasoso do magneto do espectrômetro de Ressonância Magnética Nuclear de 600MHz - 851034	R$ 137,00
Pinhé	Cabos,conector,bateria,flat	09/02/2015	Cabo multivias empregado no viscosímetro, e baterias para paquímetros digitais	R$ 110,39
Posto Pantanal	Evolux diesel s 10	14/02/2015	Diesel necessário para manutenção e funcionamento do Gerador devido a constantes quedas de energia	R$ 144,30
Antonio L Ferreira S/A Comercial e Importador	Fio rk ds, carretel vazio	20/02/2015	Fio Kanthal - Elemento de fornos de tratamento térmico usado para cristalização de vidros	R$ 225,20
RTB distribuidora	Bucha nylon,parafuso,dutotec,	27/02/2015	Material elétrico (dutos, tomadas, espelhos, disjuntor, quadro de força, fiação, etc…) para manutenção e expansão da rede elétrica no laboratório de Ressonância Magnética, Sala 6 , no IFSC/USP. Esta sala hospeda três fornos elétricos para preparação de amostras vítreas utilizadas em linhas de pesquisa do CEPID- 850998	R$ 1.811,02
Ruffino	Câmera dome IR 20 mts ccd,cartao de proximidade	02/03/2015	Substituição do equipamento de segurança	R$ 636,00
De Santis	Fitas,laminas univ, serra aço, sikasil, solvente, superbonder, thinner	04/03/2015	Materiais necessários para manutenção e reparos de equipamentos e peças do laboratório	R$ 316,00
Ruffino	Disco rígido HD 1 TB, DVR 8 canais	05/03/2015	Equipamentos de substituição, fundamentais para segurança do laboratório	R$ 800,00

J. De Santis	Alcar lixa, norton lixa, awt lamina serra, etc.	05/03/2015	Materiais utilizados para finalização de amostras e moldes.	R$ 1.029,30
Pinhé	Ferro solda, tubete, plug, fonte, lupa	10/03/2015	Ferro de solda estanho para circuito eletrônico e manipulador para soldas de fios finos	R$ 74,90
Multipack	Esponja, desinfetante, detergente, disco, luvas	13/03/2015	Material de limpeza necessário para manter a assepsia no Laboratório.	R$ 798,98
Peronti	Lençol borracha	17/03/2015	Manta para apoio de balança antivibração	R$ 51,98
RTB distribuidora	Lukma com cjx2-0910	18/03/2015	Material elétrico para manutenção e expansão da rede elétrica no laboratório de Ressonância Magnética, Sala 6 , no IFSC/USP. Esta sala hospeda três fornos elétricos para preparação de amostras vítreas utilizadas em linhas de pesquisa do CEPID- 850998	R$ 41,00
Jabu	Cabo PP IFC 4x, centro cem trilh, DGE,DISJ,LAMp kit, ste	19/03/2015	Materiais para manutenção e ajustes de equipamentos do laboratório	R$ 313,18
Jabu	Centro sob cem, disj weg, sindal, termpress	19/03/2015	Itens para adequações e manutenções elétricas	R$ 94,74
SF Áudio Vídeo e informática Imp e Exp LTDA	Tonners	20/03/2015	Os toners são indispensáveis para garantir a impressão de artigos científicos e demais documentos referentes a pesquisa.	R$ 1.192,39
SF Áudio Vídeo e informática Imp e Exp LTDA	Tripé WT 3710, memoria micro sd 32gb	21/03/2015	Suporte para Câmera filmadora, facilitando a filmagem de experimentos, fundições e outros usos de registros científicos necessários	R$ 150,00

Ca and Ma	Conector, capa DB50 e kit retenção	25/03/2015	Adapção de conector de equipamento de pesquisa	R$ 29,00
Camir parafusos	Macho man, pf st int inox	25/03/2015	Materiais para reparos na cortadeira automática buelher	R$ 241,67
Aço Mix	PU60, 90, poliacetal	01/04/2015	Confecção de suporte para micro manômetro do DSC - parte da linha de gás	R$ 175,00
Pinhé	GFSTSE PB BOTAO NA, suporte LED, led 3mm	02/04/2015	Materiais elétricos necessários para iluminação do laboratório de microscopia - Instituto de Física de São Carlos- IFSC USP	R$ 41,80
Peronti	Conector, união emenda, conexão T, etc.	09/04/2015	Itens para instalação de ar comprimido para abertura da porta do forno de fusão de vidros grande.	R$ 444,92
Qualitá	Evaporador	09/04/2015	Substituição de equipamento de refrigeração do laboratório	R$ 147,00
Ruffino	Fonte eletrônica chaveada 12 V	13/04/2015	Fonte de porta de segurança do LaMav	R$ 65,00
Montes & Biancolli LTDA	Cartucho de tinta original Canon	14/04/2015	Os cartuchos de tinta estão sendo utilizados na impressora Deskjet Canon do próprio pesquisador e na impressora do mesmo tipo que se encontra no LaMav. Estes cartuchos permitem a impressão dos resultados dos estudos e a impressão dos artigos e relatórios.	R$ 85,00
Eletro Eletrônica Gaspar	Pilha pequena duracell	16/04/2015	Baterias para materiais eletrônicos	R$ 21,00

SF Áudio Vídeo e informática Imp e Exp LTDA	PLl fireware feasso, tecl leadership	06/05/2015	Substituição de material de computador de laboratório de microscopia, essencial para funcionamento do microscópio no computador e teclado para substituir peça danificada	R$ 105,94
Olivebor comércio de artefatos de borracha	Septo 14/20, 24/40, rolha 05 e 08	07/05/2015	Rolhas e septos, para utilização em sínteses de nanopartículas metálicas. Septos são utilizados para permitir a injeção de reagentes no meio reacional as rolhas para vedar os sistema durante a síntese. O material (silicone) foi escolhido por apresentar afinidade com os solventes utilizados na síntese, mesmo assim as altas temperatura tendem a diminuir a vida útil destes componentes, reduzindo a sua reutilização.	R$ 370,60
Montes & Biancolli LTDA	Cartucho de tinta compativel HP 60XL blac e color	09/05/2015	Toner para impressão de Material de Pesquisa do Laboratório LaMav	R$ 115,00

SERVIÇO DE TERCEIROS				
FORNECEDOR	**DESCRIÇÃO**	**DATA DE EMISSÃO**	**JUSTIFICATIVA**	**VALOR**
Montes & Biancolli LTDA	Manutenção HP Laserjet 3055	12/06/2014	Manutenção e reparo em impressora HP Laserjet 3055 utilizada pelos alunos para impressão de documentos e artigos para estudos.	R$ 80,00
Aptor Consultoria e Desenvolvimento	Hospedagem, Suporte e Manutenção	03/07/2014	Manutenção e Gerenciamento do website (atualizações, acompanhamento do sistema de submissão de trabalhos e inscrições).	R$ 820,00
Recibo	Seguro saúde/Perrysburg 20/07 a 25/07	28/07/2014	Seguro saúde referente a Reunião técnica onde falei sobre o Certev: A New Glass Research Center in Brazil: Research & Technology, Owens-Illinois World Headquartes- Meeting of the Technical	R$ 170,09

Recibo	Passagens aéreas/ Perrysburg 20/07 a 25/07	28/07/2014	Passagens para reunião técnica onde falei sobre o Certev: A New Glass Research Center in Brazil: Research & Technology, Owens-Illinois World Headquartes- Meeting of the Technical.	R$ 4.646,88
Aptor Consultoria e Desenvolvimento	Hospedagem, Suporte e Manutenção	31/07/2014	Manutenção e Gerenciamento do website (atualizações, acompanhamento do sistema de submissão de trabalhos e inscrições).	R$ 580,00
Azzosil	Locação de equipamentos	05/08/2014	Serviço de terceiros pagos para transportar e instalar uma mesa óptica de 700 Kg no laboratorio de espectroscopia Raman.	R$ 2.200,00
Correios	Despacho de objeto	18/08/2014	Envio de documentos para pesquisadores participarem do X BrasGlass	R$ 183,00
FAFQ	Inscrição X BrasGlass Guilherme Macedo	22/08/2014	Inscrição de Guilherme Nunes Braga Maurício de Macedo, no X BRASGLASS, realizado em São Carlos - SP no período de 26 a 30 de Outubro de 2014. Guilherme foi aluno de iniciação Científica do professor Edgar Dutra zanotto e apresentou o poster intitulado: Photo induced crystallization of CaF2 from a Na2. O/K2O/CaO/CaF2/Al2O3/SiO2 glass,	R$ 350,00
Supplier Indústria e Comércio	Manutenção fonte	26/08/2014	Serviço de reparo em fonte utilizada para geração de campo elétrico, em forno para pesquisa de sinterização de vidros com campo elétrico aplicado.	R$ 222,00
Beatrice Allain - ME	Serviço de revisão de artigo	26/08/2014	Revisão Ingles do artigo intitulado: A Statistical Overview of glass-ceramic Science and Technology.	R$ 406,00
Aptor Consultoria e Desenvolvimento	Manutenção mensal do site	02/09/2014	Manutenção e Gerenciamento do website (atualizações, acompanhamento do sistema de submissão de trabalhos e inscrições).	R$ 300,00

Rodolfo Augusto Johansen ME	Serviços de impressão	03/09/2014	Impressão da dissertação de mestrado "Reformulação de esmaltes cerâmicos a partir de vidros de CRT" de Raúl Julian Revelo Tobar, no âmbito do CeRTEV.	R$ 116,00
Lazer e hobby artigos de presentes ltda me	Montagem de palco para apresentações teatrais	03/09/2014	Montagem de palco para apresentações teatrais do evento VIII Ciência em cena: encontro de teatro e divulgação científica, realizado em São Carlos/ Araraquara entre os dias 7 e 10 de agosto de 2014, do qual o CeRTEV foi organizador juntamente aos Núcleo de Divulgação Científica Ouroboros (UFSCar) e Grupo Alquimia (UNESP- Araraquara).A montagem foi necessária, uma vez que o auditório não possuia infra-estrutura para os grupos teatrais se apresentarem.	R$ 1.960,00
Recibo	Revisão de artigo científico	05/09/2014	Revisão de artigo para publicação : Effects of lithium oxide on the crystallization kinetics of Na2O×2CaO×3SiO2 glass.	R$ 715,50
Infomais Computadores LTDA ME	Manutenção em monitor	12/09/2014	Manutenção e reparo de monitor de equipamento do Laboratório de Pesquisa	R$ 90,00
Correios	Despacho de objeto	12/09/2014	Envio de vitroceramica de biosilicato para usinagem na unesp Bauru	R$ 17,80
Google	Hospedagem no Google	15/09/2014	Hospedagem do Aplicativo (está sendo desenvolvido) para divulgação do CERTEv/LaMaV	R$ 62,30
Correios	Despacho de objeto	15/09/2014	Amostras enviadas para a UFRGS para análise de proliferação celular	R$ 41,30
Correios	Despacho de objeto	15/09/2014	Enviado para Natasha Maurmann - UFRGS, Ensaios de proliferação celular	R$ 41,30
EDG	Serviço prestado no forno	16/09/2014	Após adquirir o forno e utilizá-lo durante algum tempo observamos que o registro da temperatura não estava sendo correto. O gasto foi referente ao conserto do termopar que havia se rompido devido ao ataque quimico por composições fluorofosfatos que fundimos.	R$ 121,94

Heraeus Vectra do Brasil LTDA	Restauração do cadinho	16/09/2014	Restauração de cadinho de platina para fundição de materias-primas e obtenção de materiais vítreos	R$ 4.400,00
Correios	Despacho de objeto	17/09/2014	Amostras de vidro enviadas para Santa Luzia - MG para análise química na FRX Service Ltda	R$ 34,70
SF Audio Video e informatica Imp e Exp LTDA	Manutenção notebook	19/09/2014	Serviço contratado necessário para o bom funcionamento do computador utilizado no laboratório LaMaV	R$ 150,00
FAFQ	Inscrição X BrasGlass Mariana Vilas Boas	25/09/2014	Inscrição de Mariana Vilas Boas no X BRASGLASS, realizado em São Carlos - SP, de 26 a 30 de Outubro de 2014. Mariana é Pos doutoranda do Prof. Edgar Dutra Zanotto e apresentou o poster: "Residual Stresses in Lithium Disilicate Glass-Ceramics for Dental Applications" no referido congresso	R$ 750,00
FAFQ	Inscrição X BrasGlass Daniel Cassar	25/09/2014	Inscrição de Daniel Cassar, no X BRASGLASS, realizado em São Carlos - SP, de 20 a 30 de Outubro de 2014. Daniel é Aluno de Pós doutorado do Prof. Edgar Dutra Zanotto e apresentou o poster: "On the possible relationship between the thermo dynamic and the kinetic Kauzmann temperature"	R$ 750,00
FAFQ	Inscrição X BrasGlass Caio Bragatto	25/09/2014	Inscrição de Caio Bragatto, no X BRASGLASS, realizado em São Carlos - SP no período de 26 a 30 de Outubro de 2014. Caio é aluno de Doutorado, orientado pela Profa. Ana Candida Martins Rodrigues e apresentou o poster: "Structural relaxation in AgPO3 studied by ionic conductivity"	R$ 380,00

FAFQ	Inscrição X BrasGlass - Prof. Marcello Andreeta	25/09/2014	Inscrição do Prof. Marcelo R. B. Andreeta no X BRASGLASS, realizado em São Carlos - SP no período de 26 a 30 de Outubro de 2014. Prof. Andreeta apresentou o poster entitulado: New Li2O-La2O3-TiO2-SiO2 transparent glass and glass-ceramic: Synthesis and preliminary characterization.	R$ 750,00
FAFQ	Inscrição X BrasGlass	25/09/2014	Inscrição do Prof. Valmor Mastelaro, no X BRASGLASS, realizado em São Carlos - SP no período de 26 a 30 de Outubro de 2014. Prof. Valmor apresentou o poster entitulado: Surface crystallization of BaO-B2O3-SiO2 glass system	R$ 750,00
FAFQ	Inscrição X BrasGlass Marcelo Bacha	29/09/2014	Incrição de Marcelo Gomes Bacha, aluno de doutorado, para participação e apresentação do trabalho "Sintering and crystallization of glasses assisted by electrical field" no 10º BRASGLASS, 26 e 30 de Outubro de 2014 em São Carlos.	R$ 380,00
Inscrição X BraSGlass	Inscrição X BraSGlass	02/10/2014	Incrição de Felipe José dos Santos, aluno de Iniciação Científica, para participação e apresentação do trabalho "Functionalizing of precursors of pores based on calcium phosphate to btain bioactive glass ceramics" no 10º BRASGLASS, 26 e 30 de Outubro de 2014 em São Carlos.	R$ 350,00
Marcelo Zampieri Ar Condicionado ME	Manutenção de um ar cond. Split	03/10/2014	Manutenção, tais como, limpeza, lubrificação e complementação de gas refrigerante. Mostrar mensagem original	R$ 1.316,00
American Journal Experts	Publicação do artigo biosilicate review v16 me1	04/10/2014	Publicação do artigo Biosilicate® a multipurpose, highly bioactive glass-ceramic. In vitro, in vivo and clinical trials no Journal of Non-Crystalline Solids (Impact Factor: 1.72). 04/2015; DOI: 10.1016/j.jnoncrysol.2015.03.022	R$ 973,08

Mantis Comunicoes LTDA	Adesivo imagem digital	15/10/2014	Adesivos para organização e identificação de salas no laboratório	R$ 332,20
FAI UFSCAR	Emenda voluntaria e extensao de patente	20/10/2014	Pagamento da Patente: "Equipamento e método para a obtenção de fibras por downdrawing a partir de composições de baixa estabilidade vítrea", patente número: BR 10 2014 023349 0, desenvolvida por: Edgar Dutra Zanotto, Marina Trevelin Souza e Oscar peitl Filho.	R$ 4.985,60
Bratrice Allain - ME	Serviços de revisao gramatical de texto científico	22/10/2014	Correção de artigo sobre: ORBITAL IMPLANTS, de autoria de Edgar Dutra Zanotto, Murilo C. Crovace e Outros	R$ 112,00
American Journal Experts	Publicação de artigo	22/10/2014	Publicação do artigo: "Characterization and biocompatibility of a fibrous glassy scaffold: Biocompatibility of a fibrous scaffold"; Journal of Tissue Engineering and Regenerative Medicine (Impact Factor: 4.43). 02/2015; DOI: 10.1002/term.2017	R$ 651,06
Menegazzo & Menegazzo	3 painéis	24/10/2014	Impressão dos posters: 1) "Reformulation of ceramic glazes from recycled CRT glass" e 2) "Functionalizing of precursors of pores based on calcium phosphate to btain bioactive glass ceramics", e 3) "Sintering and crystallization of glasses assisted by electrical field" para apresentação no 10º BRASGLASS, 26 e 30 de Outubro de 2014 em São Carlos.	R$ 141,00
Sandra Cristina Correa Ribeiro Pereira ME	01 pôster 90x120 fotográfico	24/10/2014	Poster para Professor Marcello R. B. Andreeta apresentar seu trabalho no X BRASGLASS, realizado em São Carlos - SP no período de 26 a 30 de Outubro de 2014, poster intitulado: New Li2O-La2O3-TiO2-SiO2 transparent glass and glass-ceramic: Synthesis and preliminary characterization.	R$ 33,00

Sandra Cristina Correa Ribeiro Pereira ME	03 pôster 90x120 fotográfico	24/10/2014	Impressão dos posters: "Photo induced crystallization of CaF2 from a Na2 O/K2O/CaO/CaF2/Al2O3/SiO2 glass", "On the possible relationship between the thermodynamic and the kinetic Kauzmann temperature" e "GLASS-CERAMICS BASED ON Li2O-SiO2-SYSTEM AS BONEGRAFT IMPLANTS: BIOACTIVITY AND CYTOTOXICITY STUDY" Apresentados no X BrasGlass, realizado em São Carlos	R$ 99,00
Sandra Cristina Correa Ribeiro Pereira ME	01 pôster 90x120 fotográfico	24/10/2014	Impressão dos posters: "Sintering and Crystallization of Sol-gel Derived SiO2-CaO-P2O5 Bioactive Glass"; Residual Stresses in Lithium Disilicate Glass-Ceramics for Dental Applications" e Degradability of SiO2−CaO−P2O5 and SiO2−CaO−Na2O−P2O5 bioactive gel□glasses in simulated body fluid", todos os posters foram apresentados no X BrasGlass, realizado em São Carlos - SP	R$ 33,00
Sandra Cristina Correa Ribeiro Pereira ME	03 pôster 90x120 fotográfico	24/10/2014	Impressão do Poster "New Li2O-La2O3-TiO2-SiO2 transparent glass and glass-ceramic: Synthesis and preliminary characterization.", o poster foi apresentado pelo Prof. Marcelo R. B. Andreeta, no X BrasGlass, realizado em São Carlos - SP	R$ 99,00
Simone Samara Brito - ME	Troca de telhas de policarbonato	31/10/2014	Substituição do telhado do Laboratório devido a depreciação. As telhas apresentavam rachaduras, causando danos em dias de chuvas.	R$ 1.750,00

Recibo	Recibo referente ao ajuste a débito devido à variação cambial nas compras dos livros	07/11/2014	Devido à grande mudança do dólar, foi cobrada uma taxa de ajuste de cambio. Esta taxa refere-se às compras dos livros 'functional oxides' e 'crystal growth for beginners: fundamentals of nucleation, crystal grow and epitaxy, e dvd 'bioceramics' no mês de setembro de 2014	R$ 328,48
Sandra Cristina Correa Ribeiro Pereira ME	Impressão de dados sobre pesquisa de mercado para biomateriais	11/11/2014	Impressão de acervo para pesquisa de biomateriais	R$ 69,00
Sandra Cristina Correa Ribeiro Pereira ME	01 pôster 90x120 fotográfico	11/11/2014	Impressão de pôster apresentado no X BrasGlass, pelo Prof. Oscar Peitl, o trabalho intitulado: Biosilicate Orbital implants in Rabbits and Human - Clínica Trial. O evento foi realizado em São Carlos - SP, no período de 26 a 30 de Outubro de 2014	R$ 33,00
Correios	Correios	19/11/2014	Enviado para Viviane O. Soares - Universidade Estadual de Maringá, Amostras de vidro para eletrofiação.	R$ 32,70
Ferbemar Industria e Comercio de Peças LTDA ME	Prestação de serviço de usinagem em suportes de micropipeta	20/11/2014	Suporte para ensaios invitro	R$ 200,00
Correios	Correios	21/11/2014	Envio de arquivo (resultados e artigos) de pesquisas ao Professor Jean Louis Souquet - França	R$ 187,00
Dama locadora de veículos ltda ME	Serviços de transporte de prof Jean Louis Souquet	24/11/2014	São Carlos - Guarulhos - Transporte de pesquisador visitante Jean Louis Souquet	R$ 550,00

Sandra Cristina Correa Ribeiro Pereira ME	Impressões pôster	26/11/2014	Impressão de pôster de alunos de Iniciação Científica orientados do Professor Edgar Dutra Zanotto e Ana Cândida Rodrigues, para participarem do 22° Congresso de Iniciação Científica e 7° Congresso de desenvolvimento Tecnológico e Inovação - 19 a 27 de novembro de 2014, São Carlos - SP, os trabalhos apresentados são intitulados: Influência do teor de zircônia em vitrocerâmicas do sistema MAS nas propriedades mecânicas e óticas - pôster apresentado por Gabriel Tayama); Efeito do nitrogênio na taxa de crescimento do dissilicato de lítio vítreo (poster apresentado por Norma M. P. Machado) e "Fixação por aquecimento via laser de partículas de biovidro na superfície de titânio" (poster apresentado por Gabirel B. Souza)	R$ 109,44
Menegazzo & Menegazzo	2 Painel gloos paper	02/12/2014	Impressão dos pôsteres: 1) "Sintering and crystallization of soda-lime glasses assisted by electrical field" e 2) "The effect of particle size on overall crystallization of diopside glass detected by DSC" para apresentação no 2o Encontro de Ciência e Engenharia de Materiais: Energia, Sustentabilidade e Inovação, realizado de 26 a 28 de novembro de 2014 em São Carlos.	R$ 70,00
Dama locadora de veículos	Serviços de transporte do prof Edgar Dutra Zanotto	05/12/2014	Transporte do Professor Zanotto para Guarulhos, o Professor Zanotto participou da banca de avaliação de tese de Doutorado do e um aluno do Prof. Yuanzheng Yue; Ministrarei um seminário; Visitarei os laboratórios de vidros e cerâmicas; Discutirei um projeto de pesquisa comum e intercâmbio no âmbito de um convênio já celebrado com a Universidade de Aalborg	R$ 550,00
Sergio Domingos Pereira	Serviços de transporte de alunos da escola Luiz Augusto de Oliveira para a UFSCar	12/12/2014	Serviços de transporte de alunos da escola Luiz Augusto de Oliveira para a UFSCar para participar do projeto "Engenheiros e Cientistas do Futuro" vinculado ao CeRTEV	R$ 480,00
Bogas parafusos	Dobradiça ferro, PF RM FE SIMPLES, porca sext	15/12/2014	Materiais necessários para fabricação de caixa para armazenamento de moldes em 3D e outras peças para demonstração de cristais.	R$ 4,54

Bercan indústria e comercio de inst comerc	Pintura eletrostática em 13 estruturas metálicas diversas	16/12/2014	Pintura em prateleiras, mesas e racks de equipamentos de pesquisa, e organização do laboratório.	R$ 2.510,00
Heraeus Vectra do Brasil LTDA	Restauração de cadinhos e tubo	16/12/2014	Material utilizado para conserto dos cadinhos platina utilizados para sínteses dos vidros. Esta aplicação é necessária, pois durante o processo de restauração dos cadinhos ha uma pequena perda de material.	R$ 2.502,90
Azzosil	Locação de equipamentos	17/12/2014	Esta locação de equipamento da empresa Azzosil foi realizada para transportar trêseletro-magnetos de cerca de uma tonelada cada, desde o Instituto de Química (IQSC)até o laboratório de Espectroscopia de Ressonância Paramagnética Eletrônica (RPE) doInstituto de Física de São Carlos (IFSC/USP). As dimensões e o grande peso desteseletro-magnetos exige a contratação de uma empresa especializada no transporte decargas pesadas. Estes eletro-magnetos serão utilizados para montar um novo espectrômetro de R`PE no laboratório.	R$ 920,00
FAI UFSCAR	Despesa com transporte do equipamento de sistemas de energia Ltda de São Carlos a Campinas em 30/10/2014	17/12/2014	Transporte de sistema de Energia do impedancimeto do Lamav	R$ 211,85
Netzsch	Serviços de reparo em 3 sensores do equipamento DSC Netzsch	18/12/2014	Reparo de sensor de equipamento de DSC Netzsch, utilizado para análises térmicas de vidros e outros materiais de pesquisa.	R$ 23.790,00
Correios	Correios	23/12/2014	Envio de Documentos para a FAPESP via correios devido ao período de férias e não encaminhamento de malote do posto de Apoio na UFSCar	R$ 19,40

Correios	Correios	23/12/2014	Envio de Documentos para Visto ao Pesquisador Visitante Atiar Rahaman Molla	R$ 69,00
Correios	Correios	07/01/2015	Envio de amostra (géis de sílica) para a Universidade Federal de São João Del Rei para realização de análises de TG/DTA	R$ 32,70
Heraeus Vectra do Brasil LTDA	Restauração de cadinho	19/01/2015	Material utilizado para conserto dos cadinhos platina utilizados para sínteses dos vidros. Esta aplicação é necessária, pois durante o processo de restauração dos cadinhos ha uma pequena perda de material.	R$ 383,56
Von Eisus Brasil Com. E Serv. De info	Serviços prestados	28/01/2015	Manutenção de computador de pesquisa do Laboratório, serviços necessários	R$ 120,00
Correios	Correios	29/01/2015	Envio de amostras vítreas do sistema CaO-SrO-B2O3-SiO2 dopados com diferentes concentrações de TiO2	R$ 31,90
Log Soldas	Manutenção em equipamentos de medição e controles	09/02/2015	Trata-se de gastos com instalação de sistema de controle de gases ultrapuros (incluindo registros, manometros, mangueiras, medidores de fluxo, cilindros, etc) para realização de medidas espectroscopicas com atmosfera controlada de Oxigenio e Nitrogenio.	R$ 7.930,00
Correios	Correios	09/02/2015	Enviado para Carlos Henrique Martins - Universidade de Franca, Amostras para ensaios microbiológicos	R$ 17,40
Recibo	Submissão de artigo	11/02/2015	Publicação do artigo: Effects of fragility and decoupling on nucleation	R$ 951,55
Recibo	Submissão de artigo	11/02/2015	Publicação do artigo Bioactivity and cell proliferation in radiopaque gel-derives CaO-p2O5-SiO2-ZrO2, na Materials Science & Engineering C, 2013 / 2014 Impact Factor 2.736	R$ 915,10

Correios	Correios	05/03/2015	Envio de documentos ao Professor Pesquisador Ghosh, que virá ao LaMav em Julho/2015 realizar pesquisas e transferir seus conhecimentos	R$ 69,00
Confortérmica	Transferência de ar condicionado	09/03/2015	Esta empresa foi contratada para realizar a transferência de dois aparelhos de arcondicionado no laboratório de Espectroscopia de Ressonância Paramagnética Eletrônica (RPE) do Instituto de Física de São Carlos (IFSC/USP). Estes aparelhos estavam posicionados na parede, na parte superior dos armários, com grande risco de vazar água para dentro dos mesmos. A empresa Confortérica re-ubicou estes aparelho sem locais onde não existe mais esse risco. O serviço teve um custo total de R$ 1.280,00	R$ 1.280,00
DHL	Recibo	09/03/2015	Envio de documentos para visto do Pesquisador - Pos Doutorado - Swarup Kundu.	R$ 234,00
Correios	Correios	10/03/2015	Enviado para Marco A. Schiavon- Universidade Federal de São João Del Rei, Amostras de gel para análise termogravimétrica	R$ 32,70
Maria Ap Rodrigues Estofados	Restauração de 3 cadeiras	12/03/2015	Reparos em cadeiras de bancadas de pesquisas do LaMaV	R$ 390,00
Acil & Weber comercio e serviços	Serviços de calibração, manutenção, limpeza e ajustes no equipamento analisador de densidade real automático	12/03/2015	A manutenção é fundamental para podermos utilizar o equipamento essencial com as pesquisas, nesta manutenção foram realizados: Serviços de calibração, manutenção, limpeza e ajustes no equipamento analisador de densidade real automático	R$ 2.376,00
Ciar Comercio de Motores Elétricos LTDA-ME	Serviço de rebobinamento e manutenção em motor ventilador Brasil	13/03/2015	Serviço de manutenção do motor da estufa de secagem de vidraria (substituição de bobinado e capacitor), localizada no Laboratório de Ressonância Magnética, Sala 13, no IFSC-USP.	R$ 255,00

Aleksandra Gorrera Veltroni	Passeios educativos para crianças	18/03/2015	O projeto Educare realizado em janeiro de 2015 com 20 crianças da cidade de São Carlos visou a educação científica e cultural para o público do ensino fundamental e educação infantil. De 22 a 25 de janeiro, as crianças visitaram museus científicos, parques ecológicos e fizeram atividades no espaço Educare, desenvolvendo habilidades cognitivas e comportamentais como a socialização e trabalho em equipe.Registraram as atividades em desenhos, que foram expostos no último dia das atividades. O CeRTEV foi parceiro na realização do evento, contribuindo com o transporte para as crianças que escutaram a contação da História de Vidro no dia 25 de janeiro.	R$ 350,00
Correios	Correios	27/03/2015	Amostras de vidro para medidas de viabilidade de aplicação de sensores de radiação, Universidade Federal de Goiás	R$ 47,90
Correios	Correios	27/03/2015	Envio de documentos para visto a alunos selecionados para curso em São Carlos, devido a problemas com prazo, algumas cartas precisaram ser encaminhadas via EMS - Método rápido oferecido pelos correios	R$ 389,20
Correios	Correios	02/04/2015	Envio de documentos para visto a alunos selecionados para curso em São Carlos, devido a problemas com prazo, algumas cartas precisaram ser encaminhadas via SMS - Método rápido dos correios	R$ 181,00
Perkinelmer	Manutenção corretiva no equipamento spectrum gx e lambda20	07/04/2015	Serviços realizados pelo fabricante para troca de laser e manutenção.	R$ 2.850,00
Correios	Correios	07/04/2015	Enviado para Viviane O. Soares, Universidade Estadual de Maringá - Amostras de vidro nanométrico para eletrofiação	R$ 16,50
Recibo	Serviços de submissão de artigo	08/04/2015	Submissão do Artigo: Bioactivity and cell proliferation in radiopaque gel-derived CaO-P2O5-SiO2-ZrO2 glass and glass-ceramic powders,	R$ 1.235,65

Qualitá	Carga de gás	09/04/2015	Carga de gás em equipamento de refrigeração para manter o bom funcionamento	R$ 250,00
Recibo	Seguro saúde - viagem Orlando (maio 2015)	13/04/2015	O seguro de saúde for necessário para garantir assistência de um físico no caso da emergência durante o viágem ao exterior	R$ 186,00
Correios	Correios	14/04/2015	Envio de documentos para visto a alunos selecionados para curso em São Carlos, devido a problemas com prazo, algumas cartas precisaram ser encaminhadas via SEM - Método rápido	R$ 253,80
DANUBIO AZUL CARGAS	Transporte de Areia seca para Laboratório.	14/04/2015	Transporte de material para preparo de amostras	R$ 46,30
FAI UFSCAR	Despesas relativas a emenda voluntaria e extensão da patente	20/04/2015	Pagamento de serviços de extensão do pedido de Patente depositado junto ao INPI em 19/02/2014, sob PCT/BR2015/000029 intitulado " Processo de recobrimento descontínuo utilizando um biomaterial bioabsolvível e bioativo aplicado sobre substratos sólidos, recobrimento descontínuo e seu uso	R$ 5.759,00
Recibo	Seguro saúde Marcelo Gomes Bacha - SP/Miami/SP	24/04/2015	Seguro saúde para Marcelo Gomes Bacha, aluno de doutorado, participar do ACerS-GOMD/DGG Joint Meeting de 17 a 23/05 de 2015 em Miami/EUA.	R$ 107,00
Correios	Correios	04/05/2015	Envio de documentos para visto a alunos selecionados para curso em São Carlos, devido a problemas com prazo, algumas cartas precisaram ser encaminhadas via SEM	R$ 343,20
Correios	Correios	05/05/2015	Envio de cadinho de platina para Reparos na Heraues Vectra	R$ 30,90

Correios	Correios	07/05/2015	Envio de documentos para visto a alunos selecionados para curso em São Carlos, devido a problemas com prazo, algumas cartas precisaram ser encaminhadas via SEM	R$ 359,30
EDG equipamentos	Serviços prestados no forno F1700	07/05/2015	Serviços prestados no forno F1700: Serviço de manutenção elétrica nos contatos da entrada de corrente à resistências, que estavam sobre-aquecendo e faiscando	R$ 377,40
Micro Tube Ferramentaria de precisao e comercio	Manutenção em forno do equip U.V	07/05/2015	A troca da resistência é necessária devido ao desgaste, cada vez que o forno é ligado o material aquece, sofre perdas por oxidação, ocorrem dilatação e contração causando perda física de material até que perca a capacidade de aquecimento e por fim o rompimento dos fios. A troca dos o´rings e o sistema de vedação foram necessários devido a falta de resfriamento no forno em uma ocasião que houvequeda de energia no prédio. O Forno funcionava no momento com 400°C e o sistema de vedação todo é feito com material polimérico, e com o sobreaquecimento ficaram todos danificados, sendo necessária então a substituição.	R$ 1.170,00
Correios	Correios	11/05/2015	Envio de documentos necessários para Visto de aluno participante da Escola de vidros	R$ 26,60
Correios	Correios	12/05/2015	Envio de amostras de fibras de vidro para o Prof. Boccaccini - Alemanha	R$ 45,00
Dorival Aparecido Valerio	Locação de mão de obra temporária	12/05/2015	Serviço de instalação do forno de fusão de vidros pequeno no Laboratório de Materiais Cerâmicos do SMM/EESC/USP.	R$ 700,00
Correios	Envio de Amostra	14/05/2015	Envio para Ponta Grossa vidro para UEPG Prof. Francisco; e outra amostra para Araraquara UNESP Odonto prof. Gelson ensaio de resistência a flexão.	R$ 30,50

Correios	Correios	14/05/2015	Caixa para armazenamento adequado das amostras enviadas para UEPG	R$ 6,00
Sandra Cristina Correa Ribeirao Pereira ME	Banner fotográfico	15/05/2015	Impressão dos banners: Influencia da Substituição de fósforo por Silício na Condutividade Iônica de Vitrocerâmicas Nasion e o trabalho Efeito do alumínio na condutividade iônica de vitrocerâmicas NASICON condutoras por íon sódio; Efeito de Al +3 na condutividade elétrica de vitrocerâmicas NASICON e Influencia de AlPO4 na obtenção e Propriedades elétricas de Vitrocerâmicas NASICON.Trabalhos apresentados por Adriana Munoz e Jairo mosquera no 58° Congresso Brasileiro de Cerêmica, realizado de 17 a 20 de maio de 2015 em Barra dos Coqueiros SE	R$ 140,00
Menegazzo & Menegazzo	2 Painel gloos paper	18/05/2015	Impressão dos pôsteres: 1) "Evaluation of critical cooling rate of silicate melts by the guided random parameterization method" e 2) "Sintering of glasses with concurrent crystallization assisted by DC electric field" para apresentação no ACerS-GOMD/DGG Joint Meeting de 17 a 23/05 de 2015 em Miami/EUA.	R$ 90,00
Beatrice Allain - ME	Revisão gramatical	18/05/2015	Revisão do Artigo Structural relaxation in AGPO3 Glass followed by in situ impedance Spectroscopy	R$ 585,00
Beatrice Allain - ME	Revisão gramatical	18/05/2015	Prefácio de um livro intitulado, From Glass to Crysral: Nucleation, Growth and phase separation, from research to applications, e de um artigo intitulado Crystallization of Glass-Forming liquids: Maxima of Nucleation, Growth, Andoverall Crystallization Rates.	R$ 1.045,00
Recibo	Seguro saúde - viagem Dusselgorf (15/05 a 02/06)	19/05/2015	O seguro de saúde é necessário para garantir assistência médica durante o viagem ao exterior	R$ 244,92
DANUBIO AZUL CARGAS	Transporte	21/05/2015	Transporte de matérias primas: óxidos de alumínio e argila para produção de placas de forno/transporte de matéria prima Minasolo, materias fundamentais para preparo de amostras (vidros)	R$ 250,48

Sandra Cristina Correa Ribeiro Pereira ME	Pôster sulfite	22/05/2015	Impressão do poster entitulado: Structure and nucleation mechanism in alkali and alkaline-earth diborate glasses, os autores deste pôster foram: Jefferson Esquina Tsuchida, Edgar Dutra Zanotto, Hellmut Eckert, o pôster foi apresentado no XXXVIII Encontro Nacional de Física da Matéria Condensada	R$ 20,00
Correios	Correios	25/05/2015	Envio de documentos para pesquisador visitante, os documentos são de caráter	R$ 94,00
Correios	Correios	25/05/2015	Amostras de vidros bioativos para Patrícia Alves da UNIFRAN	R$ 17,30
Celso Augusto de Araujo	Transporte pesquisador	25/05/2015	Transporte para aeroporto para participação no ACerS-GOMD/DGG Joint Meeting de 17 a 23/05 de 2015 em Miami/EUA, trajeto: São Carlos - Guarulhos.	R$ 340,00
Celso Augusto de Araujo	Transporte pesquisador	25/05/2015	Transporte para aeroporto para participação no ACerS-GOMD/DGG Joint Meeting de 17 a 23/05 de 2015 em Miami/EUA, Trajeto: Guarulhos - São Carlos	R$ 340,00
FAI UFSCAR	Despesa com transporte	28/05/2015	Transporte do Prof.Edgar Zanotto do Aeroposto de Guarulhos, o Professor retornou do 2015 Glass & Optical Materials Division and Deutsche Glastechnische Gesellschaft Joint Annual Meeting,	R$ 381,60
Recibo	Reembolso de submissão de artigo	28/05/2015	Publicação do artigo: On the kauzmann temperature and viscosity divergence in oxide glass-formers	R$ 889,50
FAI UFSCAR	Despesa com transporte	28/05/2015	O carro foi utilizado para levar o prof. Zanotto em um a reunião na FAPESP dia 12/05 e para deixá-lo no aeroporto de Guarulhos em 13/05 onde pegou voo para Miami participar do 2015 Glass & Optical Materials Division and Deutsche Glastechnische Gesellschaft Joint Annual Meeting	R$ 689,60

Recibo	Inscrição GOMD Acers	28/05/2015	A inscrição for exigida por American Ceramic Society para participação no Congresso GOMD. Nao consegui admissão sem pagamento.	R$ 2.404,54
L F Dessi e Cia LTDA	Manutenção e higienização	02/06/2015	Manutenção em equipamentos de refrigeração, sendo um do laboratório de microscopia e o do laboratório de pesquisas LaMaV	R$ 950,00

TRANSPORTE				
FORNECEDOR	**DESCRIÇÃO**	**DATA DE EMISSÃO**	**JUSTIFICATIVA**	**VALOR**
Recibo	Passagem aérea orlando 10/05/15 a 22/05/15	03/03/2015	O passagem foi necessário para Professor Hellmut Eckert, participar em um Congresso Cerámico e dar uma palestra. Alem disso foi ncessario para fazer pesquisa de campo no laboratório de um colaborador no CREOL (Central Florida University).	R$ 4.575,00
Recibo	Marcelo Gomes Bacha - SP/Miami/SP	11/05/2015	Passagem aérea para Marcelo Gomes Bacha, aluno de doutorado do professor Eduardo B. Ferreira, participar do ACerS-GOMD/DGG Joint Meeting de 17 a 23/05 de 2015 em Miami/EUA.	R$ 2.266,93
Recibo	Passagem aérea Dusseldorf (15/05 a 02/06)	18/05/2015	A viagem foi necessário para Professor Hellmut Eckert executar pesquisa do campo,usando equipamento de RMN na Universidade de Münster. Esta equipamento nao é disponivel em Sao Carlos.	R$ 3.984,99

Apresentação de seção específica para aplicação dos recursos de Benefícios Complementares
Processo 2013/07793-6 - Prestação de Contas Parcial

Passagens aéreas/terrestres			
DESCRIÇÃO	**DATA DE EMISSÃO**	**JUSTIFICATIVA**	**VALOR**
Passagem aérea - Alemanha (Rio de Janeiro/ Paris Charles de Gaule/ Frankfurt Internacional / Paris Charles de Gaule/ São Paulo Guarulhos)	15/09/2014	Passagem aérea (Rio de Janeiro/ Paris Charles de Gaule/ Frankfurt Internacional / Paris Charles de Gaule/ São Paulo Guarulhos) para a participação do "Congresso Materials Science Engineering - MSE 2014, onde o Professor, Edgar D. Zanotto apresentou o trabalho "Glass myths and marvels" em Darmstad - Alemanha".	R$ 5.847,39
Passagem de ônibus	15/09/2014	Passagem interna para participar "Congresso Materials Science Engineering - MSE 2014, onde o Professor, Edgar D. Zanotto apresentou o trabalho "Glass myths and marvels" em Darmstad - Alemanha".	R$ 49,97
Passagem aérea - SP/Honolulu	10/10/2014	Passagem aérea internacional (descrever a rota: São Paulo/ XXXXXXXXXXXXX/ São Paulo) para o Professor Marcelo Nalin participar do 59th Annual Conference on Magnetism and magnetic Materials, realido em novembro de 3-7, 2014 in Honolulu, o professor apresentou os trabalhos: Glasses Containing Magnetic Nanoparticles e Biocellulose-based Flexible Magnetic Paper.	R$ 3.684,60

Passagem aérea - SP/Dubai/Bengaluru-Hyderabad/Dubai/SP	11/11/2014	Passagem aérea internacional (São Paulo/Dubai/Bengaluru-Hyderabad/Dubai/São Paulo) para participar realizar estágio técnico e visita ao Materials Research Centre, Indian Institute of Science, Bangalore (Índia), a convite do Prof. K.B.R. Varma, seguido de participação como convidada no "International Seminar on Glasses and other Functional Materials (ISGFM)" a ser realizado entre 11 e 13 de dezembro de 2014, em Guntur, India, apresentando os trabalhos: What is a glass at Ramakrishna Mission. A profa. Ana Candida participou ainda na Sri Sathya Sai Institute of Higher Learning, Puttaparthi, India, December, 8th 2014, onde apresentou: Activities on Glass and Glass-ceramics Research at Federal University of São Carlos, Brazil, and The vitreous state.	R$ 5.445,96
Despesa de transporte utilizado na Índia	25/11/2014	Transporte interno para a Professora Ana Candida realizar o estágio técnico e visita ao Materials Research Centre, Indian Institute of Science, Bangalore (Índia), a convite do Prof. K.B.R. Varma, seguido de participação como convidada no "International Seminar on Glasses and other Functional Materials (ISGFM)" a ser realizado entre 11 e 13 de dezembro de 2014, em Guntur, India, apresentando os trabalhos: What is a glass at Ramakrishna Mission. A profa. Ana Candida participou ainda na Sri Sathya Sai Institute of Higher Learning, Puttaparthi, India, December, 8th 2014, onde apresentou: Activities on Glass and Glass-ceramics Research at Federal University of São Carlos, Brazil, and The vitreous state.	R$ 303,18

Passagem aérea - Orlando 10/05/15 a 22/05/15	03/03/2015	Gasto se refere a compra de passagem aérea para Professeroa Andrea S. S. de Camargo realizar trabalho de campo e visita científica no CREOL – College of Optics and Photonics na University of Central Florida e na empresa Optigrate Inc. em Orlando, e na sequencia para participar do 2015 Glass & Optical Materials Division and Deutsche Glastechnische Gesellschaft Joint Meeting em Miami. O trabalho de campo se resume em medidas experimentais de rendimento quântico para comparação com os resultados obtidos em nosso laboratório em S. Carlos, bem como a visita de laboratórios no CREOL onde apresentei no dia 12 de Maio o seminário "Fluorophosphate glasses doped with Er3+ e Yb3+". A ocasião tambem foi dedicada a discussao de resultados com o Prof. Leon Glebov, membro do conselho internacional do Cepid sobre resultados em vidros PTR, colaboração com o Certev. No congresso, apresentei dois trabalhos orais como justificado no item "Inscrição GOMD Acers".	R$ 4.575,00
Passagem + taxa de remarcação SP/Miami/SP	29/05/2015	Passagem internacional (Guarulho - SP/ Miami/Guarulho - SP) para Professora participar do Glass & Optical Materials Division and Deutsche Glastechniche Gesellschaft Joint Annual Meeting 2015, 17 a 21 de maio, em Miami, Florida – USA,onde apresentou de forma oral o trabalho intitulado: Crystallization kinetics of a non-stoichiometric glass monitored by electrical conductivity measurements	R$ 3.537,36
Passagens (São Paulo / Miami) - 12 a 23 de maio	08/04/2015	Passagem (São Paulo Guarilhos/ Miami / São Paulo Viracopus), para Professor Edgar Dutra Zanotto participar do GLASS & OPTICAL MATERIALS DIVISION AND DEUTSCHE GLASTECHNISCHE GESELLSCHAFT JOINT ANNUAL MEETING 2015, 17 a 21 de maio, em Miami, Florida – USA, onde presentou-se o trabalgo: The breakdown of the Stokes-Einstein-Eyring equation versus fragility of oxide glasses	R$ 1.962,55
Passagem aérea - SP/Miami/SP	08/04/2015	Assentos referente a passagem (São Paulo Guarilhos/ Miami / São Paulo Viracopus), para Prof. Edgar Dutra zanotto participar do Glass & Optical Materials Division and Deutsche Glastechniche Gesellschaft Joint Annual Meeting 2015, 17 a 21 de maio, em Miami, Florida – USA, onde presentou-se o trabalgo: The breakdown of the Stokes-Einstein-Eyring equation versus fragility of oxide glasses	R$ 609,30

DIÁRIAS			
DESCRIÇÃO	**DATA DE EMISSÃO**	**JUSTIFICATIVA**	**VALOR**
Diárias Honolulu	22/10/2014	Diárias referente a participação do Professor Marcelo Nalin no 59th Annual Conference on Magnetism and magnetic Materials, realido em novembro de 3-7, 2014 in Honolulu, o professor apresentou os trabalhos: Glasses Containing Magnetic Nanoparticles e Biocellulose-based Flexible Magnetic Paper.	R$ 4.338,42
Diárias - Munster - 14 a 24 fevereiro	09/02/2015	Diárias para o Professor Hellmut Eckert para ir até a Universidade de Münster, Alemanha, para conduzir experimentos avançados de RMN (ressonânciamagnétic nuclear), usando o meu laboratório anterior no Instituto de Química e Física. No presentemomento aindo não tenho equipamento equivalente em Sao Carlos	R$ 3.454,38
Diária São Carlos/Campinas/São Carlos	26/02/2015	Serviço de transporte- São carlos / Campinas/ São carlos)para participar da Banca de Tese de Doutorado do Sr João Henrique Lopes, intitulada: Biovidros derivados do 45S5: Os efeitos do Nb2O5 da modificação da superfície com Ca2+ sobre a estrutura e bioatividade, realizada em 27 de fevereiro de 2015 no Instituto de Química da Unicamp - Campinas	R$ 243,00
Diária São Carlos/Ponta Grossa/São Carlos	06/03/2015	Despesa de transporte (São Carlos - SP/ Ponta Grossa - PR / São Carlos - SP) para participar da dissetação da aluna Iolanda Justus Dechandt, intitulada Bioatividade de vidros no Sistema 2Na2-O.1CaO.3SiO2-P2O5, realizada em 06 de março de 2015 na Universidade Estadual de Ponta Grossa.	R$ 243,00
Diárias	04/05/2015	Diárias referente a participação do Professor Marcelo Nalin na 38a Runião Anual da Sociedade Brasileira de Química - 25 a 28 de maio de 2015/ Águas de Lindóia, SP, onde apresentou o trabalho: Recording diffraction gratings in composite materials based on epoxy-TiO2 nanoparticles	R$ 1.280,00

Diárias - São Carlos/Miami/São Carlos	29/05/2015	Diárias referente ao período de participação do Professor Eduardo Bellini Ferreira no 2015 Glass & Optical Materials Division and Deutsche Glastechnische Gesellschaft Joint Annual Meeting - GOMD - DGG, 17 a 21 de maio, em Miami, Florida – USA, onde apresentou o trabalho: Evalution of Critical cooling rate of silicate melts by the guided random parameterization method.	R$ 5.991,80

SRVIÇOS DE TERCEIROS			
DESCRIÇÃO	**DATA DE EMISSÃO**	**JUSTIFICATIVA**	**VALOR**
Inscrição congresso - 6° Encontro Nacional sobre as terras raras, realizado em Setembro de 2014 em Recife - PE	23/07/2014	Gasto com inscrição da professora Andrea S. S. de Camargo no "6o Encontro Nacional sobre as terras raras" realizado em Setembro de 2014 em Recife - PE. Neste encontro apresentei oralmente o trabalho intitulado "Spectroscopic studies of Europium (III) complexes encapsulated in mesoporous organosilica sol-gel hosts" e meus alunos apresentaram em poster, os trabalhos: 1) Chemical durability of Yb3+-doped tellurium oxychloride glass; 2) Caracterização estrutural e espectroscópica de vidros fluorofosfatos dopados e co-dopados com Er3+ e Yb3+.; 3) New Optical Materials based on Rare-Earth Doped Oxyfluoride Glasses and Ceramics: Structural and Photophysical Studies.	R$ 390,00
Inscrição Congresso Coreia	24/08/2014	Gasto com Inscrição da Professora Andrea S. S. de Camargo para participar do ISNOG2014 – International Symposium on Non-Oxide Glasses and Optical Materials realizado de 25-29 de Agosto de 2014 em Jeju, Coreia do Sul. Neste congresso apresentei o trabalho oral intitulado Towards white light generation in new oxyfluoride glasses co-doped with Tb3+ and Eu3+.	R$ 1.788,80

Inscrição X BraSGlass	17/09/2014	Inscrição do X BraSGlass, Edgar D. Zanotto apresentou CeRTEV - A New Center for Research, Technology and Education in Vitreous Materials. Trends and Challenges. Oral - Realizado em São Carlos -SP no período de 26- 30, October, 2014.	R$ 750,00
Inscrição X BraSGlass	17/09/2014	Inscrição do X BraSGlass, onde apresentou o Trabalhos: Effect of temperature of single and double heat treatments on the microstrusture and ionic conductivity od Nasicon Glass-ceramics- Oral; Realizado em São Carlos -SP no período de 26- 30, October, 2014.	R$ 750,00
Inscrição X BraSGlass	17/09/2014	Inscrição do X BraSGlass, para o professor Oscar peitl. onde apresentou o trabalho Biosilicate Orbital Implants in Rabbits and Human - Clinical Trial, o evento foi realizado no período de 26 a 30 de Outubro de 2014.	R$ 750,00
Inscrição X BraSGlass	29/09/2014	Inscrição para o Professor Eduardo Bellini Ferreira participar do X BraSGlass, realizado em São Carlos - SP no período de 26 a 30 de outubro de 2014, apresentou o poster intitulado: Glass forming ability and the crystallization of glasses in the system Na2O-CaO-SiO2.	R$ 750,00
Seguro saúde - Edgar	29/09/2014	Seguro saúde referente a participação do “Congresso Materials Science Engineering - MSE 2014, onde o Professor, Edgar D. Zanotto apresentou o trabalho “Glass myths and marvels” em Darmstad - Alemanha”.	R$ 136,88
Inscrição X BraSGlass	10/10/2014	Inscrição para o Professor José Fabian Schneider participar do participar do X BraSGlass, realizado em São Carlos - SP no período de 26 a 30 de outubro de 2014 onde paresentou de forma oral o trabalho: Mixed ion effect and cation distribution in phosphate glasses.	R$ 600,00
Inscrição/Honolulu	10/10/2014	Inscrição do professor Marcelo Nalin para participar do 59th Annual Conference on Magnetism and magnetic Materials, realido em novembro de 3-7, 2014 in Honolulu, o professor apresentou os trabalhos: Glasses Containing Magnetic Nanoparticles e Biocellulose-based Flexible Magnetic Paper.	R$ 1.348,04

Inscrição X BraSGlass	10/10/2014	Inscrição para o professor Marcelo Nalin participar do X Bras Glass, realizado em São Carlos de 26 a 30 de outubro de 2014, o Professor Nalin apresentou de forma oral o Strucutral and Optical properties of B2O3-BiF3 Glasses. Oral	R$ 750,00
Inscrição GOMD Acers	05/12/2014	Gasto referente ao pagamento de inscrição (Professora Andrea S. S. de Camargo) para participar do 2015 Glass & Optical Materials Division and Deutsche Glastechnische Gesellschaft Joint Meeting realizado em Miami, EUA, de 17-21 de Maio de 2015. Neste congresso apresentei os trabalhos orais intitulados “Optical and spectroscopic properties of tungsten phosphate glasses containing silver nanoparticles” e “Efficient red emission of Eu3+-doped new tungsten phosphate glasses”.	R$ 2.404,54
Seguro saúde - viagem Orlando (maio 2015)	13/04/2015	O seguro saúde para Professora Andrea S. S. de Camargo, referente ao periodo em que se realizou pesquisa de campo, visita cientifica e participação em congresso em Orlando e subsequentemente Miami.	R$ 186,00
Seguro saúde - SP/Miami/SP	24/04/2015	Seguro saúde referente a participação do Professor Eduardo Bellini Ferreira no 2015 Glass & Optical Materials Division and Deutsche Glastechnische Gesellschaft Joint Annual Meeting - GOMD - DGG, 17 a 21 de maio, em Miami, Florida – USA, onde apresentou o trabalho: Evalution of Critical cooling rate of silicate melts by the guided random parameterization method.	R$ 107,00
Passagem SP/Miami/SP	08/05/2015	Passagem internacional (Guarulho - SP/ Miami/Guarulho - SP) para Professora participar do Glass & Optical Materials Division and Deutsche Glastechniche Gesellschaft Joint Annual Meeting 2015, 17 a 21 de maio, em Miami, Florida – USA,onde apresentou de forma oral o trabalho intitulado: Crystallization kinetics of a non-stoichiometric glass monitored by electrical conductivity measurements	R$ 2.163,13
Reembolso seguro saúde	27/05/2015	Seguro saúde necessário para a vigem do professor Edgar D. Zanotto, onde participou do 2015 Glass & Optical Materials Division and Deutsche Glastechnische Gesellschaft Joint Annual Meeting - GOMD - DGG, 17 a 21 de maio, em Miami, Florida – USA, onde presentou-se o trabalgo: The breakdown of the Stokes-Einstein-Eyring equation versus fragility of oxide glasses e ministrou o curso: Nucleation, Growth and Crystallization in Glasses—Fundamentals and Applications	R$ 155,00

Reembolso inscrição	29/05/2015	Inscrição para participar do 2015 Glass & Optical Materials Division and Deutsche Glastechnische Gesellschaft Joint Annual Meeting - GOMD - DGG, 17 a 21 de maio, em Miami, Florida – USA, onde presentou-se o trabalgo: The breakdown of the Stokes-Einstein-Eyring equation versus fragility of oxide glasses e ministrou o curso: Nucleation, Growth and Crystallization in Glasses—Fundamentals and Applications	R$ 2.588,80
Reembolso taxa de inscrição Miami	29/05/2015	Taxa de inscrição referente a participação da Professora Ana Candida no Glass & Optical Materials Division and Deutsche Glastechniche Gesellschaft Joint Annual Meeting 2015, 17 a 21 de maio, em Miami, Florida – USA,	R$ 2.477,24
Reembolso inscrição Miami	29/05/2015	Gasto referente a Inscrição para Professor Eduardo Bellini Ferreira participar do Glass & Optical Materials Division and Deutsche Glastechniche Gesellschaft Joint Annual Meeting 2015, 17 a 21 de maio, em Miami, Florida – USA,onde apresentou de forma oral o trabalho intitulado: Crystallization kinetics of a non-stoichiometric glass monitored by electrical conductivity measurements	R$ 2.402,57
Inscrição Evento em Águas de Lindóia	29/05/2015	Inscrição para o professor Marcelo Nalin participar da 38a Runião Anual da Sociedade Brasileira de Química - 25 a 28 de maio de 2015/ Águas de Lindóia, SP, onde apresentou o poster intitulado: Recording diffraction gratings in composite materials based on epoxy-TiO2 nanoparticles	R$ 720,00

DIÁRIAS				
FORNECEDOR	**DESCRIÇÃO**	**DATA DE EMISSÃO**	**JUSTIFICATIVA**	**VALOR**
Diárias	2 diárias internacionais para o MSE-2014	04/09/2014	Diárias necessárias para professor Edgar Dutra Zanotto participar do Congresso Materials Science Engineering - MSE 2014,onde apresentou o trabalho “Glass myths and marvels” em Darmstad - Alemanha”.	R$ 1.117,90
Recibo	Diária Karina Lupetti - São Carlos/Araraquara/São Carlos	08/01/2015	Reunião para organização do IX Ciência em Cena, com a participação do Ouroboros e Alquimia. Prestação de contas com o Prof. Dr. Rodrigo Marques do VIII Ciência em Cena.	R$ 243,00

Recibo	Diárias (11 a 21/05/14 Miami e Orlando/EUA)	27/04/2015	Manutenção de diárias (hospedagem e alimentação) para realizar trabalho de campo e visita científica no CREOL – College of Optics and Photonics na University of Central Florida e na empresa Optigrate Inc. em Orlando, e na sequencia para participar do 2015 Glass & Optical Materials Division and Deutsche Glastechnische Gesellschaft Joint Meeting em Miami. O trabalho de campo se resume em medidas experimentais de rendimento quântico para comparação com os resultados obtidos em nosso laboratório em S. Carlos, bem como a visita de laboratórios no CREOL onde apresentei no dia 12 de Maio o seminário "Fluorophosphate glasses doped with Er3+ e Yb3+". A ocasião tambem foi dedicada a discussao de resultados com o Prof. Leon Glebov, membro do conselho internacional do Cepid sobre resultados em vidros PTR, colaboração com o Certev. No congresso, apresentei dois trabalhos orais intitulados "Optical and spectroscopic properties of tungsten phosphate glasses containing silver nanoparticles" e "Efficient red emission of Eu3+-doped new tungsten phosphate glasses".	R$ 9.219,09
Recibo	Diárias (11 a 21/05/14 Miami e Orlando/EUA)	27/04/2015	As diárias foram necessarios para pagar os custos de hotel e alimentação durante meu viagem a Florida.	R$ 9.219,09
Recibo	Diária Jairo Mosquera	11/05/2015	Diária para o Aluno Jairo Felipe participar do 58° Congresso Brasileiro de Cerêmica, realizado de 17 a 20 de maio de 2015 em Barra dos Coqueiros SE, onde apresentou os trabalhos na forma de poster: Influencia da Substituição de fósforo por Silício na Condutividade Iônica de Vitrocerâmicas Nasion e o trabalho Efeito do aluminio na condutividade iônica de vitrocerâmicas nasicon condutoras por íon sódio	R$ 860,00
Recibo	Diária Adriana Munoz	11/05/2015	Diária para a Aluna Adriana participar do 58° Congresso Brasileiro de Cerêmica, realizado de 17 a 20 de maio de 2015 em Barra dos Coqueiros SE, onde apresentou os trabalhos, na forma de posters: Efeito de Al +3 na condutividade elétrica de vitrocerâmicas NASICON e Influencia de AlPO4 na obtenção e Propriedades elétricas de Vitrocerâmicas NASICON.	R$ 860,00
Recibo	Diária - Campinas/Miami/Campinas - Marcelo Bacha	27/05/2015	Diárias para Marcelo Gomes Bacha, aluno de doutorado, participar do ACerS-GOMD/DGG Joint Meeting de 17 a 23/05 de 2015 em Miami/EUA.	R$ 5.991,80
Recibo	Diárias São Carlos/Santo André/São Carlos	29/10/2015	Diárias para pesquisa na Universidade Federal do ABC, durante o dia 22 de outubro, realizada pelo pesquisado Clever Ricardo Chinaglia, Pós doutorando orientado por Edgar Dutra Zanotto, foi discutir possíveis ensaios em Biomateriais, de interesse tanto de seu projeto de pós-doutorado quanto de minha área de pesquisa na UFABC	R$ 441,50

TRANSPORTE				
FORNECEDOR	**DESCRIÇÃO**	**DATA DE EMISSÃO**	**JUSTIFICATIVA**	**VALOR**
Recibo	Passagem aérea Orlando 10/05/15 a 22/05/15	03/03/15	A passagem foi necessário para Professor Hellmut Eckert, participar em um Congresso Cerámico e dar uma palestra. Alem disso foi necessário para fazer pesquisa de campo no laboratório de um colaborador no CREOL (Central Florida University).	R$ 4.575,00
Recibo	Marcelo Gomes Bacha - SP/Miami/SP	11/05/2015	Passagem aérea para Marcelo Gomes Bacha, aluno de doutorado do professor Eduardo B. Ferreira, participar do ACerS-GOMD/DGG Joint Meeting de 17 a 23/05 de 2015 em Miami/EUA.	R$ 2.266,93
Recibo	Passagem aérea Dusseldorf (15/05 a 02/06)	18/05/2015	A viagem foi necessário para Professor Hellmut Eckert executar pesquisa do campo,usando equipamento de RMN na Universidade de Münster. Este equipamento não é disponível em São Carlos.	R$ 3.984,99