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CeRTEV – Center for Research, Technology and Education in Vitreous Materials

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Research Progress

1. Overview

Materials designed and engineered for technological applications must invariably meet or exceed multiple key specifications. Even if commercial realization is not intended, scientific interest is piqued if a challenging combination of properties is achieved, particularly if they are mutually exclusive for certain classes of materials. For example, the combination of mechanical toughness, chemical durability, and high thermal-shock resistance, with pore-free, smooth, aesthetically beautiful surfaces simultaneously realized in certain glasses that are crystallized in a controlled manner glass-ceramics-have enabled two distinct, decade-long applications, cookware, and flat cooktop panels. Other special glass-ceramic materials have been developed for electronic, photonic, dental, and biomedical applications. No other class of material could combine these properties in such an advantageous and economically feasible manner. As highlighted in a recent dedicated issue of the Materials Research Bulletin, glass-ceramics owe their importance and continuing interest to "hard-to-combine" properties [1].

Recognizing this enormous technological potential of glass-ceramics, the **Ce**nter for **R**esearch, **T**echnology, and **E**ducation in **V**itreous Materials (CeRTEV) was founded in 2013 within the framework of FAPESP's CEPID program. It comprises 14 principal investigators and their co-workers at the Federal University of Sao Carlos (UFSCar), the University of São Paulo (USP), (both located in São Carlos) and the State University of Sao 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 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 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.

In addition to studies on the fundamentals of structure and dynamic processes in glass forming materials, 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) *bio active glasses 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.

2. Fundamental Aspects

Glass-ceramics are produced by controlled annealing bulk glasses according to optimized time/temperature programs. The latter are developed on the basis of classical nucleation theory, which offers predictions of the temperatures and magnitudes of the maximum nucleation, growth, and overall crystallization rates of glass-forming liquids. Within the framework of this theory the variation of the maximum nucleation rate temperature (T*) with respect to the glass transition temp. T_g has been analyzed and compared with experimental results. For six stoichiometric oxide systems that are known to exhibit homogeneous nucleation. For such systems, T* is consistently found to be higher than T_g, whereas this is not necessarily observed for glasses nucleated via the heterogeneous mechanism [2]. In this context, the well-documented failure of albite and B_2O_3 glass to crystallize at all in the absence of seeding can be explained: For these materials, the predicted temperatures of the maximum homogeneous nucleation rates are located well below their glass transition temperatures (T_g), in a region of very high viscosity, which leads to extremely long nucleation time-lags and low nucleation rates. At and above the T_g, where crystallization is normally observed, the extent of supercooling is very low, resulting in a low thermodynamic driving force for crystallization and hence low nucleation rates. This phenomenon can be related to the significant difference in the structures of the supercooled liquids and their isochemical crystals [3].

During the review period, further theoretical work was undertaken to explore the failure of classical nucleation theory (CNT) towards a quantitative description of the experimental rates

of homogeneous nucleation as a function of temperature. This discrepancy can be reconciled by assuming that the size of the structural units that control nucleation increases with decreasing temperature for $T < T^*$. The size of the structural units can be related either to the size of the cooperatively rearranging regions (CRR) or to an effective size parameter, accounting for corrections in the theoretical treatment of the kinetics of aggregation in multi-component systems via a quasi-one-dimensional description [4].

The temperature at which the (classical) critical nucleus size is equal to the average size of the CRR in a supercooled liquid has been referred to as a "cross-over" temperature T_{CO}. Using published nucleation rate, viscosity, and thermo-physical data, we show, for the first time, that in lithium disilicate melt T_{CO} is significantly larger than the temperature of the kinetic spinodal and is equal or close to T*. We suggest that the abnormal decrease in nucleation rates below T_{CO} is most likely because, in this regime, the CRR size controls the critical nucleus size and the nucleation rate. This finding links, for the first time, measured nucleation kinetics to the dynamic heterogeneities in a supercooled liquid [5].

Another unexplained phenomenon observed for a variety of oxide glass-forming liquids concerns the thermodynamic barrier for homogeneous crystal nucleation, W_c, which exhibits an unusual increase with a decrease in the temperature region below T*. As a possible explanation, internal elastic stresses that arise due to density misfits between the crystal and liquid phases have been invoked. For this purpose, crystal nucleation rates and induction time data for two glasses that display such misfits, lithium and barium disilicates, have been analyzed to estimate the effect of strain upon the work of critical cluster formation. The computations take into account not only the most stable crystal phase but also the possibility that different metastable phases may form during the early stages of nucleation. We show that elastic stresses do indeed reduce the thermodynamic driving force for crystallization, and thus increase the barrier to nucleation. However, the sole effect of elastic strain energy cannot explain the aforementioned unusual behavior of the thermodynamic barrier [6]. Hence, a comprehensive explanation to this phenomenon remains an open issue.

In the area of simulation, new two- and three-body potentials have been developed, enabling molecular dynamics simulations of barium disilicate melts, yielding excellent agreement with neutron diffraction structure factors and the vibrational density of states of this material [7]. The latter in fact matches very closely the simulated vibrational density of crystalline barium disilicate (sanbornite) and produces an excellent match with the phonon spectrum measured by Raman spectroscopy [7].

3. High-Strength Glass-Ceramics

High-strength glass-ceramics are important for applications for armor (bullet-proof vests and windows) as well as for restorative dentistry. As such, vital research efforts in this area focus on the development of new ceramic formulations and the characterization of their key mechanical properties. In this context, controlled annealing conditions were developed for homogeneous crystallization of a new series of lithium calcium silicate glasses in the absence of nucleation agents [8]. The best mechanical properties were exhibited by a composition of 44 mol% $CaSiO_3$ heat-treated at 498 °C for 24 h for nucleation and at 700 °C for 2 h for crystal growth. This composition resulted in a glass-ceramic with the following microstructural features and properties: average Li_2SiO_3 (LS) crystal size of 8.5 μm, wollastonite (CS) phase surrounding the LS crystals with approx. 50% LS crystallized volume fraction, a fracture toughness of 2.3 ± 0.5 MPa $m^{1/2}$, biaxial strength 270 ± 20 MPa, a Vickers hardness of 8.4 ± 0.7 GPa and an elasticity module of 146 ± 8 GPa. These are exceptional mechanical properties for glass-ceramics intended for load bearing applications.

Other crystallization studies focused on heterogeneously nucleating aluminosilicate glass-ceramics, such as virgilite $Li_xAl_xSi_{3-x}O_6$ [9], and in-situ monitoring of mechanical properties upon ceramization in the SiO_2-Al_2O_3-MgO system [10]. A new transparent glass-ceramic based on the crystallization of gahnite ($ZnAl_2O_4$), which is formed from a SiO_2-K_2O-ZnO-Al_2O_3-TiO_2 melt [11]. The presence of TiO_2 results in a brownish coloration, which can be eliminated by small amounts of CeO_2 additives. The formation of albite glass ceramics, $NaAlSi_3O_8$, still presents a long-standing frontier in this research field. While the latter glass has never been crystallized at ambient pressure, at least partial crystallization was obtained in a gel-derived albite sample containing some carbon as a nucleating agent, by heat treatment near 1000-1030 °C. In the absence of nucleating catalysts even the gel-derived samples show no crystallization, confirming the extremely high stability of albite glass [12]. Another important application area for high-strength glass-ceramics is restorative dentistry. Here, the material must present a combination of multiple properties, such as esthetics, translucency, low thermal conductivity, high strength, chemical durability, biocompatibility, wear resistance, and hardness similar to that of natural teeth. As described in a recent review article [13], they can be divided into two groups, restorative and bioactive. Most restorative dental glass-ceramics (RDGCs) are inert and biocompatible and are used in the restoration and reconstruction of teeth. Bioactive dental glass-ceramics (BDGCs) display bone-bonding ability and stimulate positive biological reactions at the material-tissue interface.

4. Bioactive Glasses and Ceramics

Bioactive Glasses and Glass-Ceramics is a relatively new field of inquiry, inspired by the life work of the late Professor Larry Hench, whose groundbreaking have been summarized in a new

review paper dedicated to his memory [13]. Thanks to his seminal work this class of biomaterials has become an emerging research field for bone and soft tissue engineering applications. The compositions, processing, properties, and applications of commercial and promising types of BGCs have been summarized in a recent book chapter [14]. New developments concerning magnetic BGCs, radio-opaque BGCs, composites, coatings, gel-derived BGCs, scaffolds and their relevant issues are reviewed and discussed. Research activities at CeRTEV have been continuing along previous lines, focusing on the development of new formulations, the characterization of their physical properties and their biological properties. For example, new bioactive glass based scaffolds containing flexible fibers were developed to improve the performance of bioactive glasses in the application field and their in vitro and in vivo biocompatibility were assessed. In addition, fibroblast and osteoblast cells were seeded in contact with these scaffolds to study cell proliferation and genotoxicity and also tested in vivo by implantation into rats. The biomaterial elicited increased fibroblast and osteoblast cell proliferation, and no DNA damage was observed. The in vivo experiments showed degradation of the biomaterial over time, with soft tissue ingrowth into the degraded area and the presence of multinucleated giant cells around the implant, leading to complete degradation within 60 days. The results highlight the potential of this fibrous, glassy material for bone regeneration, due to its bioactive properties, non-cytotoxicity, and biocompatibility. Future investigations should focus on translating these findings to orthotopic applications [15]. In another effort, bioactive glass fiber-reinforced poly-(glycerol sebacate) (PGS) matrix composites were developed with the objective of cartilage regeneration. The incorporation of silicate-based bioactive glass fibers could double the composite tensile strength in comparison to pure PGS, tailor the polymer degradability, and improve the scaffold bioactivity [16]. We further studied the *in vitro* bioactivity, the viability of stem cells, and antibiofilm effect against Streptococcus mutants of two bioactive gel-glass $60SiO_2$-$36CaO$-$4P_2O_5$ (BG-A) and $80SiO_2$-$15CaO$-$5P_2O_5$ (BG-B) compositions [17]. For the *in-vitro* viability test using mesenchymal stem cells (MSCs), the BG-B showed significantly higher cell viability compared to the BG-A composition. This can be related to the higher solubility of the latter in SBF, which results in increased ion concentrations not favorable for cell proliferation. Thus, by varying the composition of glasses, and consequently their dissolution rate, it is possible to favor bioactivity, antimicrobial activity or stem cell proliferation for a particular application of interest.

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

Ion conducting glass-ceramics have shown significant promise for applications as solid electrolytes in high energy storage devices. The highest lithium ion mobilities in the solid state

are generally encountered in crystalline compounds with highly disordered cation sub-lattices, termed *superionic crystals*. Nevertheless, ion conducting glasses have the advantage of not suffering from grain boundary effects and hence form more homogeneous interfaces with the anode and cathode compartments of a solid-state electrochemical cell. Thus, dense glass ceramics based on the crystallization of suitable precursor glasses offer the promise of combining both favorable features. The CeRTEV research agenda focuses on the further development of such systems, based on a solid understanding of composition – structure – performance relationships. Also, fundamental research conducted in this CeRTEV sub-area is aimed at the understanding of non-linear composition/function relationships in new ion conducting glasses.

5.1. Glass-ceramics based on the NASICON structure.

Ion-conducting glass-ceramics based on lithium titanium phosphate and lithium germanium phosphate glasses, which crystallize in the NASICON (**Na S**uper**I**onic **Con**ductor) lattice, have already attracted commercial interest as membrane separators in lithium/air batteries. We have reviewed the current state of the art in this field [18] and contributed new homogeneously crystallizing formulations with competitive ionic conductivities [19]. CeRTEV's most recent efforts in this area aim at the development of materials with longer-term sustainability. Motivated by the much larger natural abundance of the element sodium in comparison to lithium we are now focusing on the development sodium-based (rather than lithium-based) compositions. Currently, we are therefore exploring phase relations and ionic conductivity/structure relations of glass ceramics generated from NATP and NAGP [20]. Successful preparation of single-phase crystalline compounds with additional incorporation of Na^+ ions was accomplished both through aliovalent Ge -> Al cationic substitution and through aliovalent PO_4^{3-} -> SiO_4^{4-} anionic substitution, Both approaches lead to significantly enhanced ionic conductivities which are comparable to those measured in the analogous lithium-based materials. A detailed combined X-ray diffraction and solid-state NMR characterization of these materials reveals that Al substitution for Ge (or Ti) occurs in a statistical manner, and results in profound changes in the local Na^+ environments of the sodium ion sub-lattice [20].

5.2. Composition- Structure- 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). A well-known example is the mixed

alkali effect (MAE) which describes a dramatically decreased ionic mobility and electrical conductivity, as one mobile alkali ion is substituted by one of its homologs at fixed overall cation content. In the present review period, the MAE has been investigated, for the first time, for a series of Rb- and Cs-containing mixed alkali metaphosphate glasses [21]. No straightforward correlation was found between the magnitude of the effect and the size difference of the ions involved, which may indicate some deviations from the pure statistical mixing of the two alkaline species involved, as previously suggested from solid state NMR work. In future work it will be interesting to characterize the MAE by isothermal ionic conductivity measurements of the electrical conductivity as a function of time. As demonstrated during the past review period for a silver metaphosphate glass, this method offers interesting mechanistic information about structural relaxation processes accompanying ionic jumps in glasses [22]. As such this method may be well-suited to explore the concept of *matrix- mediated coupling*, proposed by Roling and Ingram some time ago for the mixed alkali effect, from an experimental perspective. Another way to modify the ionic conductivity of a glass with constant mobile ion content is by means of network former mixing (NFM). In this case, the ionic conductivity may either increase (positive NFM effect) or decrease (negative NFM effect), depending on the system under investigation. As previously shown by us via solid state NMR, a positive NFM effect is associated with a preference for hetero-atomic linkages over homo-atomic linkages in the network. For example, in boron phosphate glasses, the concentration of P-O-B linkages significantly exceeds the value expected on the basis of a random connectivity scenario. These linkages serve to disperse the negative charge in the macro-anionic network more effectively, thereby generating Coulomb traps that are shallower than those present in single-network former systems. During the present review period this charge dispersal mechanism was further supported by $^{31}P\{^{6}Li\}$ and $^{11}B\{^{6}Li\}$ double resonance NMR studies [23]. In contrast, a negative NFM effect observed is observed for lithium boron tellurite glasses. Most recent NMR studies have shown that in this case, the number of heteroatomic B-O-Te linkages is lower than expected by statistical probability, consistent with an incipient domain segregation phenomenon [24]. These new results support the previously established working hypotheses summarized in our recent review paper [25]. For comparison, a fundamental study of mixed network former effects was also carried out in the modifier-free system SiO_2-B_2O_3-P_2O_5. Our NMR results give strong evidence for preferred B-O-P connectivity in this glass system, providing a good structural rationale for the compositional dependence of thermal and mechanical stabilities [26].

6. Photonic Glasses and Glass-Ceramics.

M. Nalin and some of his CeRTEV collaborators have published a comprehensive two-part

review highlighting the inseparable connection between glassy materials and light. Part I introduces the most promising types of luminescent glasses currently in use [27], while Part II focuses on thin films, fibers, and various application fields [28]. CeRTEV's three distinct research activities in this area include 1) new glass and glass- ceramic formulations and structure–property relations in laser glasses, 2) development of new luminescent guest-host hybrid materials, and (3) mechanistic studies on glasses undergoing photothermal refractive and photocrystallization effects.

6.1. New Formulations and Structure-Property Relations in Laser Glasses

The design of high-efficiency luminescent glasses and glass-ceramics for lasers in the near-infrared spectral region is at the core of the CeRTEV research agenda. These systems are based on luminescent rare-earth ions which must be well-dispersed within low-phonon environments to minimize vibrational de-excitation. During the review period, we pursued the design of numerous heavy metal oxide glass frameworks with various application foci. These studies include exploring new methods of glass and glass ceramic preparation using the coacervate method [29, 30], thermally stimulated luminescence studies [31]. Analyses of absorptive/emissive behavior within the framework of Judd-Ofelt theory [32], and quantum cutting and up-conversion investigations of glasses co-doped with two different rare-earth species [33]. All of these efforts are accompanied by detailed structural studies, using vibrational (FTIR/Raman), nuclear magnetic resonance, and electron spin resonance spectroscopies, which provide insights both into the organization of the glassy framework and into the distribution and local bonding environments of the luminophores. Specifically, the following formulations were investigated:

a) Dy^{3+}/Tb^{3+} co-doped $PbGeO_3$:PbF_2:CdF_2 glass phosphors, presenting tunable visible light emission in the region of the low correlated color temperature range using under UV-blue LED light excitation. Emission around 484, 573, 663, and 754 nm due to dysprosium, and 488, 545, 585, 620, and 690 nm owing to terbium ions, was observed and analyzed as a function of the dysprosium and terbium contents and excitation wavelength. The tint of the tunable overall emission resided in the warm region of the white-light boundary of the CIE-1931 chromaticity diagram [34].
b) Pr^{3+}/ Yb^{3+} co-doped oxy-fluoro-tellurite glasses with composition TeO_2-ZnO-YF_3-NaF-$0.5Pr_2O_3$-xYb_2O_3 (x = 0.25, 0.5, 0.75 and 1.0 mol%) [33]. In this system the down-conversion process results in emission in the visible (Pr^{3+}: $^3P_0 \rightarrow {}^3F_2$transition, 640 nm) and in the IR (Yb^{3+}: $^2F_{5/2} \rightarrow {}^2F_{7/2}$, 980 nm) spectral regions upon excitation at 440 nm. Due to the reverse-energy transfer mechanism from Yb^{3+} $^2F_{5/2}$ level to $Pr^{3+1}G_4$ level, luminescence intensity quenching was observed for the $^2F_{5/2} \rightarrow {}^2F_{7/2}$ transition at 980

nm, for Yb^{3+} concentrations >0.5 mol%. The energy transfer efficiency reached 66 % for a glass co-doped with 0.5 Pr^{3+} and 1.0 Yb^{3+} (mol%).

c) Rare-earth doped oxide (WO_3-$NaPO_3$) and oxy-fluoride (TeO_2-ZnO-YF_3-NaF) glasses doped with silver nanoparticles [35,36] For these systems our mechanistic studies cast doubt on the role of silver nanoparticles, as postulated in the literature, in enhancing emission intensities via the local electric field effects.

d) $SbPO_4$-$PbGeO_3$ glasses doped with $MnCl_2$, presenting a valence change for the manganese dopants upon crystallization, resulting in dramatic changes in optical properties and electron paramagnetic resonance spectra [37].

Our continuing efforts aiming at improving the photophysical properties of rare-earth doped laser glasses were accompanied by detailed structural studies using solid state NMR and EPR spectroscopies. Studies over a wider range of alkaline earth aluminum fluoride phosphate glasses reveal clear correlations between excited state lifetimes and emission intensities with increasing fluoride content. The fraction of directly bonded fluoride versus phosphate ligands in the first coordination sphere of the rare-earth species could be quantified on the basis of $^{45}Sc\{^{31}P\}$ and $^{45}Sc\{^{19}F\}$ rotational echo double resonance (REDOR) spectroscopy. This quantification assumes that the Sc^{3+} ions can serve as diamagnetic mimics for luminescent trivalent rare-earth species [38]. Similar correlations could be observed in in a series of lead fluoroborate glasses with variable fluoride contents [39]. Incorporation of TeO_2 turned out to meet with comparable success. A strong network former mixing effect is observed indicating preferential tellurite-phosphate connectivity in the region of high TeO_2 contents [40].

6.2 Luminescent Guest-Host Hybrid Materials

New luminescent hybrid materials were developed based on the incorporation of the polynuclear complex $Cu_4I_4py_4$ into mesoporous silica [41]. The well-dispersed guest molecules exhibit strong interaction with molecular oxygen, resulting in a significant luminescence quenching- The process is highly reversible with a Stern-Volmer constant K_{sv} = 33.8, which is the largest value found in the literature for similar complexes in the solid state. These results suggest that this hybrid material is a promising candidate for high sensitivity oxygen sensing. Time-Dependent DFT calculations reveal a weak intermolecular interaction between two guest molecules in the excited state, suggesting the formation of a triplet excited state complex (excimer). This conclusion is confirmed by temperature- and concentration-dependent experiments, and it provides a new way to rationalize the giant Stokes shifts observed for this complex in different media.

6.3. Mechanistic Studies of Photothermal Refractive Glasses

Photo-thermo-refractive (PTR) glass is an optically transparent photosensitive sodium alumino silicate glass, containing NaF and KBr additives, along with cerium, silver, tin and antimony oxide dopants. UV-exposed regions of this glass produce NaF nanocrystals upon heating, giving rise to a permanent, localized refractive index change. This is the basis for the production of Bragg gratings. We have published a thorough analysis of the mechanisms of refractive index changes starting with the photo-induced process followed by the crystal nucleation mechanism and NaF crystallization kinetics [42]. The initial photoionization process was examined by continuous-wave and pulsed X-band electron paramagnetic resonance (EPR) spectroscopy [38]. UV exposure of PTR glass produces unpaired electrons whose EPR spectrum is characterized by pronounced magnetic hyperfine coupling of the unpaired electrons with ^{121}Sb and ^{123}Sb nuclei. These results indicate that the Sb_2O_3 dopant plays a key role in the initial stages of the crystallization mechanism. Upon thermal annealing, leading to the crystallization of NaF, these species disappear, indicating their transient character. Together with more recent results from optical spectroscopy, these results support the model proposed by Nikonorov involving: (1) photoionization of Ce^{3+}, (2) transfer of this electron to Sb^{5+} species to create a Sb^{4+} species, (3) upon annealing electron transfer from Sb^{4+} to Ag^{+} ions, producing silver atoms, (4) coalescence of these species into Ag clusters, which (5) serve as nucleation catalysts for NaF nanocrystals [43].

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EDUCATION AND OUTREACH ACTIONS

Ana C. M. Rodrigues -*Coordinator*
M. Nalin - UNESP
J. P. Rino - UFSCar
Karina Lupetti (post-doc) - UFSCar

The CeRTEV Education and Outreach strategy encompasses two general ***Groups of Action***: ***Group A*** aims at developing and bolstering professional qualifications in glass science and technology, while ***Group B*** strives to promote glasses as strategic materials to both targeted audiences and the general public.

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

1) The "Glass Technology" Course.

As pointed out and justified in our previous reports, our main activity in this group is the development of 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.

This semester, an agreement between "The Center Paula Souza" and the Brazilian Glass Industry "Nadir Figueiredo" was signed stating that Nadir Figueiredo will fund the necessary renovation of the laboratories in the Center Paula Souza. When this renovation is ready, the Paula Souza Center will have all the necessary infrastructure to start the course, scheduled for the first semester of 2018. This new course has been reported on p. 16 of the Centro Paulo Souza electronic journal: http://www.cps.sp.gov.br/publicacoes/revista/2017/edicao-58-maio-junho.pdf

CeRTEV members do their part in developing and presenting ***workshops*** in glass science and characterization within the international community. These activities include a glass-ceramics internet course taught by Professor Zanotto, in association with the International Materials Institute (IMI), see

http://www.lehigh.edu/imi/teched/GlassProcess/Lectures/Lecture15_ZanottoA1.pdf and a solid state NMR workshop taught by Professor Eckert, at the University of Montpellier to the International MaMaSELF Masters Programme (Erasmus Mundus, February 2017). Finally, most of our glass classes are now available on youtube:

https://www.youtube.com/watch?v=6U0IIodQujs&list=PLYkqBrOsu1yCxMLTcb7Y6zwj_smIb5w5x and https://www.youtube.com/watch?v=AB9H6v3Ctew&list=PLYkqBrOsu1yA2-K5wQZjn1WSs8U7BtJ-5

Group B: Diffusion of basic and glass science

Printed Materials

An important part of CeRTEV's outreach effort in Group B includes the development of informative and creative ***printed Materials*** and ***websites***. Four ***Comic Book*** (HQs) volumes discussing the properties and curiosities associated with "glass" were produced and widely distributed to students. Volume 1 deals with basic properties and the history of glass; Volume 2 is about glass production and recycling. Volumes 3 and 4 introduce optical fibers and bioglasses. A fifth volume, entitled 'The Glass Age" is still being created. These Comics Books may be seen at: http://www.vidro.ufscar.br/#manga

2000 copies of each volume were printed, and 3000 HQs were distributed to elementary school students at various events such as: Science Circus (September / 2015 and May and October / 2016), SBPC Youth (July / 2015), National Science Week and Technology (October / 2015 and October / 2016), II Workshop on Scientific Disclosure and Leisure Activities (November / 2016); Exhibition spaces that received visits such as LaMaV-DEMa and Ventura-DQ, in São Carlos; Out of São Carlos, we can mention: JALEQUIM (II Jornada de Actividades Lúdicas e Educação em Química) April / 2016- UFG-GO, Goiânia, state of Goiás) for 150 students of higher education; 80 copies for the libraries of different schools of the Franciscan Culture Association, located in different municipalities from the state of Minas Gerais and São Paulo, as well as from the city of São Paulo.

The Pint of Science event was born in England in 2013 as an initiative of researchers of the Imperial College London. CeRTEV participated in one of the sessions in São Carlos, along with 10 other countries and 600 cities around the world in 2017. (http://www.pintofscience.com.br/). The CeRTEV session took place at the West Brothers bar and was entitled: *Welcome to the Glass Age: A Solid or Liquid*? and was presented by 3 Crete faculty: Andrea Simone Stucchi de Camargo Bernardez, Edgar Dutra Zanotto and Ana Candida Martins Rodrigues. After the presentation, the public asked many questions. One of the more attractive subjects was about Gorilla Glass, which can be found in our cell phones.

In addition to the lectures, the public could also appreciate the presentation of the glass orchestra Vitreous Sounds, which mix conventional instruments and instruments made of glass to play well-known songs to the general public. More than 200 people attended the lectures and were able to talk to the researchers, learn about the scientific dissemination initiatives of CeRTEV and receive the Glass Comics manga.

Theatrical productions and presentations

The scientific theater of the Ouroboros Group has been active since 2005 and since then hundreds of thousands of people have been able to share varied scientific information through the group's interactive and irreverent theater. Since 2014, the group is supported by CeRTEV for its productions that have been attended by more than 4000 people at diverse academic events and scientific dissemination congresses in Brazil. New pieces created bearing a relation to glass and natural sciences include: *Science and Art* (2014); *Madame Curie* (2014); *Magic X Science* (2014); *Lucis est vita* (2015); *Molecular Pan* (2016); *Go out, Zika!* (2016); *Peter Q Pan*: *in search of Ouroboros* (2016); *The Adventures of the Little Prince* (2016); *Vitreous Sounds* (2016); *The Glass Age* (2017- debut). Besides these, formerly created plays have also been presented, such as: *Science that laughs*; *The treasure of Gaia*; *Magic X Science*; *Petit Curie* and *The Sowed Truth*.

CeRTEV has co-organized the 11th edition of the "Science in Scene" event, which brings

together groups of scientific theater from various regions of Brazil, Portugal and Spain. The event has at the same time a formative purpose in the scientific dissemination area, as well as being a research activity for the participants.

Vitreous Sounds

Glass musical instruments are being built to compose a glass orchestra. The meeting of professional and amateur musicians, among them some visually impaired, make the project *Sons Vítreos* something innovative and unique in the world. The tuning of the musical instruments is achieved with the aid of luthiers, glassmakers and scientists so that they can be played with perfection by the group. Triangles, bassoons, berimbau, sweet, transverse and pan flutes have been created, as well as the carillon, quartz, kalimba and the organ of bowls. The ukulele, glass and glass drum are in the process of being created. The inventory of instruments also includes conventional instruments like accordion, guitar and timba. The glass orchestra was also highlighted in two local TV reports:

- http://g1.globo.com/sp/sao-carlos-regiao/jornal-da-eptv-2edicao//videos/v/ufscar-tem-orquestra-com-instrumentos-feitos-de-vidro-no-laboratorio-de-quimica/5563158/
- http://g1.globo.com/sp/sao-carlos-regiao/bom-dia-cidade/videos/v/orquestra-de-vidro-da-ufscar-se-apresenta-pela-1a-vez/5517562/

Exhibition "Glass World" (mundo de vidro) at Scientific Dissemination events

The itinerant exhibition "Glass World" is composed of demonstrative experiments aiming to present some properties and curiosities of vitreous materials. The demonstrative experiments address topics such as light conduction by optical fiber, colored glasses by different transition metals, photosensitive and flexible glasses, and how a glass may become "invisible" in a liquid (glycerin) with the same refractive index as the glass rod. Acoustic properties are illustrated using an organ of bowls. Rupert's droplets were used to demonstrate the resistance of thermally annealed glasses. A science and art exhibition was also presented. This exhibition brings "crystals" 3D-printed from optical microscopy photographs of the corresponding crystals in glass-ceramics. This inclusive exhibition, designed to also meet visually impaired people, was also a subject of a local TV report: http://g1.globo.com/sp/sao-carlos-regiao/jornal-da-eptv-2edicao//videos/v/ufscar-tem-orquestra-com-instrumentos-feitos-de-vidro-no-laboratorio-de-quimica/5563158/

The interactive exhibition was presented at various events during 2014 and 2017, among them: Open University / Science Circus in 2015 (5000 people), SBPC Youth in 2015 (20000 people) National Science and Technology Week in 2015 (2000 people) Circus of Science itinerant in 2016 (2500 people). In 2017, the exhibition of glass objects was divided between Ventura space (DQ-UFSCar) and LaMaV (DEMa-UFSCar), receiving sporadic visitors throughout the period.

Sow Science

In conjunction with CEPID Genoma, an action was taken on the São Paulo subway to publicize subjects related to glass: 3 posters and an informative website were settled and the 2-month campaign enabled thousands of people to get in touch with curiosities about the material glass.

The received feedback, by e-mail or through the website www.vidro.ufscar.br, showed that this was an interesting way to reach the general public. The web-site attained 5000 hits.

Vitreous Minute

Up to now, eighteen 1-2 minutes radio programs, broadcast by Radio UFSCar 95.3 FM, have been created. The musical background of the narratives consists of sounds made by glass musical instruments.

Workshop LaMaV 40 years

The Laboratory of Vitreous Materials completed 40 years of activities in December 15, 2016. A commemorative event was organized together with a workshop aiming to publicize the work done by LaMaV in this 40 years, as well as the perspectives for future work. A one-minute presentation by researchers and honorees of LaMaV was part of the event that also featured the musical presentation of "Vitreous Sounds".

TECHNOLOGY, TECH TRANSFER AND INNOVATION

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 report

Overview of Objectives and Strategies

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 on 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 funding

programs such as PIPE/FAPESP; and ***iii) extensive promotion of invention 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 and stronger 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.

Overview of former achievements and last-year results

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

Several new steps were taken to establish cooperation agreements and licensing of technologies commissioned by industry and/or developed by CeRTEV team.

H. Eckert finished a joint research project with the with Nippon Electric Glass company, concerning the characterization of scratch resistant glasses by NMR (R$280,000.00). A.C.M. Rodrigues performed technical services "*Risk analysis of the second batch of opal plates supplied by Nadir Figueiredo for analysis by calorimetry, microscopy and X-ray diffraction*" commissioned by the Brazilian glass company Nadir Figueiredo (3 projects totaling R$ 9.160,00) finished in August 2016). E.B. Ferreira extended for 6 months the Rhodia (Brazil) project to conduct analyzes for "use of biomass for the production of glass", finishing it in February 22nd 2017 (total R$ 43.323,87). E.D. Zanotto established a Material Transfer Agreement (MTA) with Ivoclar Vivadent for testing of a dental glass-ceramic giving a step further aiming at tech-transfer of the corresponding knowledge developed at CeRTEV. That same researcher also received an award grant from Nippon Sheet Glass, finished in 2017 (R$ 15,000) to determine which equation best describes the viscosity curves of strong and fragile glasses in a wide viscosity range from the *liquidus* to the glass transition range. M. Nalin has a NDA signed with SGD Brazil, a Brazilian glass company producer of containers for perfumery & cosmetic and pharmaceutical industry, and runs a 2-year research partnership agreement with the same company (total of R$ 115,920.00, from November/2015 to October/2017). M. Nalin started negotiations for a research project with the company Verescence (http://verescence.com.br/). M. Andreeta will start a research project with the company Alacer Biomedical for "Development of solid state pH sensors", expected to start in mid-2017 (totaling R$ 173,250.00). E.D. Zanotto was recently appointed to serve as the Chair of the Scientific Council of the ***Instituto Serrapilheira***, the first private research foundation within Brazil (detailed below), and started a research project funded by this Institute (total of R$ 265,000.00). The total funding from private companies thus amounted R$ 902,476.87 in the last 2 years (July 2015 – July 2017).

E.D. Zanotto also finished a consulting agreement participating in the Owens-Illinois Glass, O-I (USA) Technical Advisory Boarding (TAB) for 3 years. Unfortunately, a research project

funding by O-I did not materialize due to complicating issues regarding IP, as both partners (O-I and UFSCar) have not agreed to share patents rights!

Further cooperation agreements will be pursued in accordance with the research advances made in each area.

Nucleation of spin-off companies from the group activities

In August 2014 the first spin-off company from CeRTEV, VETRA High-Tech Glass and Glass-Ceramic Products, was established in São Carlos by three CERTEV researchers, based on their doctoral and post-doctoral research achievements. This 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.

In 2015-2016 VETRA was licensed by UFSCar (as Titular) via the University Innovation Agency to exploit two patents resulting from CeRTEV's research efforts: BR 10 2013 020961 9 and BR 10 2014 003817 5 (detailed below). As part of the strategy to turn such efforts into innovation, the first patent above was extended to the USA (US14/911,444) and Europe (FU140801PEP) through a Patent Cooperation Treaty (PCT) application (PCT: BR2014/000275) supported by part of the CeRTEV budget to Tech-Transfer, which has disbursed R$41.031,13 in April/2016 for this purpose. The second patent is being analyzed for a Patent Cooperation Treaty (PCT) application as well. As part of the same strategy, two proposals of **Innovative Research in Small Business** (PIPE/ FAPESP) were developed in collaboration with VETRA and submitted to FAPESP in 2016-2017, having Oscar Peitl and E.D. Zanotto as supervisors at the university.

In 2016-2017, the following two **Innovative Research in Small Business** (PIPE/ FAPESP) proposals were approved: **Pipe Fase II Direct (2015/17175-3)**, "*Development of Methodologies for the Production of High Purity Bioactive Glasses in Industrial Scale*", and **Pipe Fase I (2016/08458-4)**, "*Development of green-friendly cosmetics with bactericidal and healing effects for anti-acne application*".

The company has also actively participated in outreach activities such as lectures given at the following events: "*2nd International Forum on Innovation in Assistive Technology, Sports and Health*", held at UFSCar, São Carlos, SP, November 16 to 18 2016, and "*XII Cycle of Lectures on Technological Development: Entrepreneurship*", held at UFSCar, São Carlos, SP, Brazil, April/May 2017. In addition, dissemination is done through radio programs, newspapers and magazines. A proposal was also submitted to FAPESP in collaboration with another company *Essentii Technology and Innovation* (Ribeirão Preto, SP, Brazil). In 2017 the USA patent extension (US14/911,444) was granted. The company also collaborates for clinical research with the Institute of Orthopedics of the *Hospital das Clínicas de São Paulo*.

Extensive promotion of innovation and technology transfer

Patents filed in the Brazilian National Instituteof Industrial Property (INPI)

The following patent and other intellectual property applications were filed at the Brazilian National Institute of Industrial Property (INPI) by CeRTEV researchers, resulting from their scientific and technological efforts in the main fields of interest of our CEPID.

- Peitl. O., Zanotto, E.D., Milani S.B., Schellini. S. - IMPLANTE PARA REPOR VOLUME EM CAVIDADES ANOFTÁLMICAS EM HUMANOS OU ANIMAIS,

PROCESSO DE OBTENÇÃO DO MESMO, DISPOSITIVO PARA FRESAMENTO DE IMPLANTES E SEU USO. INPI, filled June 2017

- Zanotto, E.D., Santos G.M., Crovacce, M. - COMPÓSITO VIDRO-MINERAL E PROCESSO DE SINTERIZAÇÃO PARA OBTENÇÃO DE COMPÓSITO VIDRO-MINERAL - INPI, filled on 17/03/2017
- The USA patent extension (US14/911,444), mentioned above, was granted.
- In progress: "Process and product of Calcium and Strontium Polyphosphate Coacervates" (in Portuguese). Inventors M. Nalin (IQ/UNESP) et al.

These patents are being analyzed at INPI, which may take from 7 to 10 years. Some of them are also being analyzed by the UFSCar Innovation Agency for a Patent Cooperation Treaty (PCT) application.

Other activities for promotion of innovation and technology transfer

E.D. Zanotto accepted the invitation to chair the Scientific Council of the new privately-funded *Instituto Serrapilheira*, which is financed by the donation of R$ 350 million to a patrimonial fund, made by documentarist João Moreira Salles, from the founding family of Unibanco, and his wife, Branca Moreira Salles. This institute, which is the first private science funding institution in Brazil aims to support Brazilian researchers in the natural and exact sciences, such as Medicine, Biology, Mathematics, Chemistry, Physics and Engineering. The goal is to identify and support top-level young scientists engaging in ground-breaking research. About 70-100 people will be selected, who will receive up to R$ 100,000 each. Winners will be announced at the end of this year and funds will be deposited in 2018. After one year, the most promising projects will be able to win grants valued up to R$ 1 million in three years, totaling R$ 18 million/year. While this initiative cannot alleviate the currently dramatic erosion of federal and state resources available for scientific activities in Brazil, its focus on first-rate and cutting-edge scientific and technological research does address an important gap in the current national research funding scenario. In our view, the selection of CeRTEV's director for this particular assignment is vivid testimony of our CEPID's documented success in the areas of basic science and technology.

In February 13th2017, Isabela Piccirillo concluded her Master degree on Production Engineering at UFSCar, supervised by prof. S.L. Silva (CeRTEV's Tech Transfer Manager) and entitled "*Project management challenges in a research center: diagnosis and implantation of practices from the agile approach*", based on the CeRTEV experience. The work of I. Piccirillo & S.L. Silva is intended to help CeRTEV in promotion of its innovation and technology transfer strategy. Their CeRTEV-related activities include: i) administering a training course for the members of CeRTEV on how to use the **Trello** web-based project management application (June 2017), ii) organization of a **Technology Roadmapping (TRM)** for members of CeRTEV and external USP students, detailed below (November/December 2016); iii) participation in the Symposium on Production Engineering, 2016, Bauru/SP, Brazil; and iv) participation in the X Workshop of the Institute of Innovation and Product Development Management (IGDP): *Product Innovation Management: Current Research and Practices*, 2016, Betim/MG, Brazil.

The ***Technology Roadmapping*** **(TRM)**, course mentioned above, was carried out as a partnership between the Advanced Innovation Center of the São Carlos Engineering School (EESCIn-USP) and CeRTEV, aiming to contribute to the planning and management of innovation in the group. TRM is a tool for identification of technological routes, helping the technological innovations. The TRM strategy was applied to a PhD project entitled *Glass*

sintering aided by electrical field, carried out by M.G. Bacha and supervised by E.B. Ferreira, as a case study. This was a first joint effort between EESC In-USP and CeRTEV in promotion of innovation and technology transfer strategy, a partnership expected to increase collaboration between both institutions.

In addition to the above steps CeRTEV members engaged actively in the development of new analytical devices, thereby enhancing the Center's equipment & scientific instrumentation pool, as described below:

- C. Magon (IFSC/USP) and the group of Electron Paramagnetic Resonance (EPR) at IFSC-USP built a new continuous wave spectrometer based on few commercial parts abandoned from upgraded Bruker systems at other institutions. After the reconditioning of the magnet, microwave bridge and cavity, all remaining electronic parts, including computer interface and programming, were constructed from scratch. The equipment is now being tested. Besides the improvement of facilities, this step will render the group less dependent on commercial manufacturers.

- M. Andreeta (LaMaV/UFSCar) and his group are developing new laser microheaters based on the multiphonic relaxation of Nd^{3+}.

- M.Nalin constructed an optical spectrometer capable of monitoring the formation of metal nanoparticles upon annealing *in-situ*.

- E.B. Ferreira (EESC/USP) and his team engaged in research of glass sintering assisted by electrical fields. They are extending the technology for a friendly furnace environment enabling both optical dilatometry and electrical field application to sintering (PhD thesis submitted by M.G. Bacha, supervised by E.B. Ferreira)

A Portuguese Web-based content on glass science technology named **Wikividros** was created as an open collaboration platform hosted at https://wikividros.eesc.usp.br/ and is being built in collaboration with the Informatics Technical Section (STI-EESC) technical staff at USP, based in the software DokuWiki (mentioned above). The hosting of **Wikividros** as a public website on EESC's server computer was approved by the EESC head office. A first general text on glass technology is being revised for publication and formation of content on glass science and technology to compose the website will be promoted among the members of CeRTEV and its partners.

A National Industrial Advisory Board (NIAB) for CeRTEV was created. It is composed of members of the Commission on Glass of the Brazilian Ceramic Society (ABCeram), created in September/2015 (http://abceram.org.br/historico/). This is expected to improve the partnership with ABCeram and industry represented or in contact of the mentioned team. E.B Ferreira (CeRTEV's Tech-Transfer Coordinator) is also a member of this board, which is composed of the following individuals:

- *Carlos Mazzotti* – CETEV Verallia
- *César Rodrigues* – Vichie Desenvolvimento Empresarial Ltda.
- *Edison Toporcov* – Wheaton
- *Eduardo Bellini Ferreira* – EESC-USP

- *Fábio dos Santos Bernardo* – Consultor
- *Gerson Cesar Balestero* –Consult
- *Marcelo Adriano Fernandes Guerra* – Saint-Gobain SEFPRO
- *Mauro Akerman* – Escola do Vidro / ABCERAM
- *Samuel Marcio Toffoli* – Poli-USP / ABCERAM
- *Thais Christy Roncaglia Sangaleti* – UBV
- *Thiago Metti* – Raw-Material
- Pierre Frisch, who is not a member of ABCeram, but is a well-known glass expert and consultant in Brazil.

List of publications resulting from the grant to which the scientific report refers in the period July 2016-June 2017: (IAB members in **red**, international collaborators in **blue**)

a. Articles in scientific journals and book chapters

Between Jan. 2016 - June 2017 (1.5 years), we published 76 articles on glasses and related materials. As in the previous year, 33% of these articles were co-authored by international collaborators.

Number of publications in the period: 76 (~8.5 per PI)
Papers with collaboration within CeRTEV: 26 (34 %)

The CeRTEV started in July 2013, and the evolution of the number of articles on glasses and related materials produced by our team is the following:
2014 – 15 articles
2015 – 35
2016 – 37
2017 – 39 (until June 21). This total accounts for approximately 15% of all "glass" papers produced in Brazil.

CERTEV Publications (2016-2017)

1. Fundamentals of Glass Science: Structure, Crystallization and Glass-ceramics

1.1. General Issues and Reviews

The glassy state of matter. Its definition and ultimate fate, **Zanotto, E.D.**; **Mauro, J. C.,** Journal of Non-Crystalline Solids, 2017, in press.

Bibliometrics in glass and other sciences: A Plea for reason, Montazerian, M., **Zanotto, E.D., Eckert, H.**, Int. J. Applied Glass Science, 2017, in press.

Glass-ceramics and realization of the unobtainable: Property combinations that push the envelope, Davis, Mark J.; **Zanotto, Edgar D.,** MRS Bulletin (2017), 42(3), 195-199. Invited

The microscopic origin of the extreme glass-forming ability of Albite and B_2O_3, Zanotto, E.D., Cassar, D.R., Scientific Reports, (2017) art. no. 43022.

Role of dynamic heterogeneities in crystal nucleation kinetics in an oxide supercooled liquid, Gupta, Prabhat K.; Cassar, Daniel R.; **Zanotto, Edgar D.,** Journal of Chemical

Physics (2016), 145(21), 211920/1-211920/7.

Crystal nucleation in glass-forming liquids: Variation of the size of the "structural units" with temperature, Fokin, Vladimir M.; Abyzov, Alexander S.; **Zanotto, Edgar D.**; Cassar, Daniel R.; Rodrigues, Alisson M.; **Schmelzer, Jürn W. P.,** Journal of Non-Crystalline Solids (2016), 447, 35-44

On the variation of the maximum crystal nucleation rate temperature with glass transition temperature, Gupta, Prabhat K.; Cassar, Daniel R.; **Zanotto, Edgar D.,** Journal of Non-Crystalline Solids (2016), 442, 34-39.

The effect of elastic stresses on the thermodynamic barrier for crystal nucleation, Abyzov, Alexander S.; **Fokin, Vladimir M.**; Rodrigues, Alisson Mendes; **Zanotto, Edgar D.**; **Schmelzer, Jürn W. P.,** Journal of Non-Crystalline Solids (2016), 432 (Part_B), 325-333.

The effect of elastic stresses on the thermodynamic barrier for crystal nucleation, Abyzov, Alexander S.; **Fokin, Vladimir M.**; Rodrigues, Alisson Mendes; **Zanotto, Edgar D.**; **Schmelzer, Jürn W. P.,** Journal of Non-Crystalline Solids (2016), 432 (Part_B), 325-333.

Crystallization, mechanical, and optical properties of transparent, nanocrystalline gahnite glass-ceramics Molla, Atiar R.; Rodrigues, Alisson M.; Singh, Shiv Prakash; Lancelotti, Ricardo Felipe; **Zanotto, Edgar D.; Rodrigues, Ana C. M.**; Reza Dousti, Mohammad; **de Camargo, Andrea S. S.**; **Magon, Claudio Jose**; Silva, Igor D'Anciaes Almeida**,** Journal of the American Ceramic Society (2017), 100(5), 1963-1975.

On the crystallization of gel-derived albite ($NaAlSi_3O_8$): the most stable oxide glass, Siqueira, Renato Luiz; **Peitl, Oscar**; **Zanotto, Edgar Dutra,** Journal of Sol-Gel Science and Technology (2016), 80(3), 619-625.

Structural and dynamic properties of vitreous and crystalline barium disilicate: molecular dynamics simulation and Raman scattering experiments, Rodrigues, A. M.**; Rino, J. P.; Pizani, P. S.; Zanotto, E. D.,** Journal of Physics D: Applied Physics (2016), 49(43), 435301/1-435301/10.

1.2. Techniques and Tools (12)

Recoupling dipolar interactions with multiple I=1 quadrupolar nuclei: A $^{11}B\{^6Li\}$ and $^{31}P\{^6Li\}$ rotational echo double resonance study of lithium borophosphate glasses, Funke, Lena Marie; Bradtmueller, Henrik; **Eckert, Hellmut,** Solid State Nuclear Magnetic Resonance (2017), in press

Advanced Magnetic Resonance Techniques for the Structural Characterization of Aminoxyl Radicals and Their Inorganic-Organic Nanocomposite Systems, Eckert, Hellmut, Chemistry - A European Journal (2017), 23(25), 5893-5914.

GlassPanacea: A user-friendly free software tool for the formulation of glasses, glass-ceramics, and ceramics (Short Survey) Siqueira, R.L.' Alano, J.H. **Peitl, O. Zanotto, E.D.** American Ceramic Society Bulletin (2017), 96, (1), 48-49

Structural relaxation in $AgPO_3$ glass followed by in situ ionic conductivity measurements, Bragatto, C.B.; Cassar, D.R.; **Peitl, O.; Souquet, J.-L.**; **Rodrigues, A.C.M.**, Journal of Non-Crystalline Solids, Vol. 437, p. 43-47, 2016

Determination of Crystal Growth Rates in Glasses Over a Temperature Range Using a Single DSC Run, Reis, Raphael M. C. V.; **Fokin, Vladimir M.**; **Zanotto, Edgar D.** Journal of the American Ceramic Society (2016), 99(6), 2001-2008.

2. Mechanical and Thermal Properties of Glass-Ceramics

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Microstructure and mechanical properties of nucleant-free Li_2O-CaO-SiO_2 glass-ceramics, Santos, Gisele G.; Serbena, Francisco C.; **Fokin, Vladimir M.**; **Zanotto, Edgar D.** Acta Materialia (2017), 130, 347-360.

In situ crystallization and elastic properties of transparent MgO-Al_2O_3-SiO_2 glass-ceramic, Sant'Ana Gallo, L., **Célarié, F., Audebrand, N.**, **Martins Rodrigues, A.C., Zanotto, E.D.**, **Rouxel, T.** - Journal of the American Ceramic Society (2017), in press.

Effect of P_2O_5 on the Nonisothermal Sinter-Crystallization Process of a Lithium Aluminum Silicate Glass, Soares, Viviane Oliveira; **Zanotto, Edgar Dutra,** International Journal of Applied Ceramic Technology (2016), 13(5), 948-955.

3. Bioglasses

3.1 General Issues and Reviews

A guided walk through Larry Hench's monumental discoveries, Montazerian, Maziar; **Zanotto, Edgar D.,** Journal of Materials Science (2017), in press. Invited

Bioactive and inert dental glass-ceramics, Montazerian, M., **Zanotto, E.D.** Journal of Biomedical Materials Research - Part A (2017) 105 (2), p619-639.

Chapter 2: Bioactive Glass-ceramics: Processing, Properties and Applications Montazerian, M., **Zanotto, E.D.** (Book Chapter) RSC Smart Materials 2017 (23), 27-60. Invited

History and trends of bioactive glass-ceramics, (Review), Montazerian, M., **Dutra Zanotto, E., Journal of Biomedical Materials Research - Part A (2016) 104 (5), 1231-1249.**

3.2. New Applications of Biosilicate

Biosilicate/PLGA osteogenic effects modulated by laser therapy: In vitro and in vivo studies, Fernandes, K.R.; Magri, A. M. P.;Kido, H. W., Parisi, J. R.; Assis, L., Fernandes, K. P. R., Mesquita-Ferrari, R. A.; Martins, V. C.; Plepis, A. M.; **Zanotto, E. D.**; **Peitl, O,** Renno, A.C.M. Journal of Photochemistry and Photobiology B: Biology (2017), 173, 258-265.

haracterization and biological evaluation of the introduction of PLGA into biosilicate® Fernandes, K.R., Magri, A.M.P. Kido, H.W.' Ueno, F., Assis, L., Fernandes, K.P.S., Mesquita-Ferrari, R.A.' Martins, V.C., Plepis, A.M.' **Zanotto, E.D., Peitl, O.,** Ribeiro, D., Van den Beucken, J.J., Renno, A.C.M. **Journal of Biomedical Materials Research - Part B Applied**

Biomaterials (2017), 105, 1063-1074.

Biosilicate - A multipurpose, highly bioactive glass-ceramic. In vitro, in vivo and clinical trials, Crovace, Murilo C.; Souza, Marina T.; Chinaglia, Clever R.; **Peitl, Oscar**; **Zanotto, Edgar D.** Journal of Non-Crystalline Solids (2016), 432(Part A), 90-110.

3.3. New Formulations, Structural Characterization and Functional Assessment

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Bioglass and resulting crystalline materials synthesized via an acetic acid-assisted sol-gel route Siqueira, Renato L.; Costa, Laiza C.; Schiavon, Marco A.; de Castro, Denise T.; dos Reis, Andrea C.; **Peitl, Oscar**; **Zanotto, Edgar D.,** Journal of Sol-Gel Science and Technology (2017), 83(1), 165-173.

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3.4. Scaffolds, Composites, Biological Studies

Characterization and biocompatibility of a fibrous glassy scaffold, Gabbai-Armelin, P.R. Souza, M.T.Kido, H.W.Tim, C.R. Bossini, P.S., Fernandes, K.R., Magri, A.M.P., Parizotto, N.A. Fernandes, K.P.S. Mesquita-Ferrari, R.A., Ribeiro, D.A., **Zanotto, E.D**. **Peitl, O.,** Renno, A.C.M **Journal of Tissue Engineering and Regenerative Medicine (2017) 11 (4)141-1151**

Bioactive glass-based surfaces induce differential gene expression profiling of osteoblasts, E. P. Ferraz, F. S. Oliveira, P. T. Oliveira, M. C. Crovace, **O. Peitl Filho**, M. M. Beloti, A. L. Rosa, Journal of Biomedical Materials Research A (2017) 105, 419-423.

Bioactive gel-glasses with distinctly different compositions: Bioactivity, viability of stem cells and antibiofilm effect against Streptococcus mutans, Siqueira, Renato L.; Maurmann, Natasha; Burguez, Daniela; Pereira, Daniela P.; Rastelli, Alessandra N. S.; **Peitl, Oscar;** Pranke, Patricia; **Zanotto, Edgar D.,** Materials Science & Engineering, C: Materials for Biological Applications (2017), 76, 233-241.

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Novel Double-Layered Conduit Containing Highly Bioactive Glass Fibers for Potential Nerve Guide Application, Souza, Marina Trevelin; **Peitl, Oscar; Zanotto, Edgar Dutra**; **Boccaccini, Aldo R.** International Journal of Applied Glass Science (2016), 7(2), 183-194. Invited

SEM and AFM characterization of surface of two RMGICs for degradation before and after modification with bioactive glass ceramic, Osorio, Estrella; Osorio, Raquel; **Zanotto, Edgar D.**; **Peitl, Oscar**; Toledano-Osorio, Manuel; **Toledano, Manuel,** Journal of Adhesion Science and Technology (2016), 30(6), 621-632.

4. Glasses and Ceramics for Energy Storage (25)

4.1. NASICON-based Solid Electrolytes

Ion-conducting glass-ceramics for energy-storage applications, Eckert, Hellmut; **Martins Rodrigues, Ana Candida,** MRS Bulletin (2017), 42(3), 206-212. Invited

A new NASICON lithium ion-conducting glass-ceramic of the $Li_{1+x}Cr_x(Ge_yTi_{1-y})_{2-x}(PO_4)_3$ system, Nuernberg, R. B., **Rodrigues, A C M** Solid State Ionics 301 (2017) 1–9.

Preparation, Structural Characterization, and Electrical Conductivity of Highly Ion-Conducting Glasses and Glass Ceramics in the System $Li_{1+x}Al_xSn_yGe_{2(x+y)}(PO_4)_3$, Santagneli, Silvia H.; Baldacim, Helio V. A.; Ribeiro, Sidney J. L.; Kundu, Swarup; **Rodrigues, Ana Candida Martins**; Doerenkamp, Carsten; **Eckert, Hellmut,** Journal of Physical Chemistry C (2016), 120(27), 14556-14567.

4.2. Cation and Network Former Mixing Effects

Structural characterization of AgI-$AgPO_3$ -Ag_2WO_4 superionic conducting glasses by advanced solid state NMR, M. Blais-Roberge, S. H. Santagneli, S. H.Messaddeq, M. Rioux, Y. Ledemi, **H. Eckert**, **Y. Messaddeq**, Journal of Physical Chemistry C., 2017, in press.

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Non-random bonding of mono/divalent cations in mixed phosphate glasses, Schneider, Jose F.; Fontes, Gabriel Barroco Zinn, Journal of Non-Crystalline Solids (2017), Ahead of Print.

Network Former Mixing (NFM) Effects in Ion-Conducting Glasses.Structure/Property Correlations Studied by Modern Solid-State NMR Techniques, **H. Eckert** (invited review), In Diffusion Foundations, H. Mehrer, ed., TransTech. Publ. Vol. 6, 144-193 (2016). Invited

Charge Compensation in Sodium Borophosphate Glasses Studied by $^{11}B\{^{23}Na\}$ and $^{31}P\{^{23}Na\}$ Rotational Echo Double Resonance Spectroscopy, Funke, Lena Marie; **Eckert, Hellmut,** Journal of Physical Chemistry C (2016), 120(6), 3196-3205

4.3. Other Electrical and Magnetic Glassy Materials

A luminescent europium ionic liquid to improve the performance of chitosan polymer electrolytes, Leones, R., Reis, P.M., Sabadini, R.C., Ravaro, L.P., Silva, I.D.A**., de Camargo, A.S.S., Donoso, J.P., Magon, C.J.,** Esperança, J.M.S.S., Pawlicka, A.,Silva, M.M.**,** Electrochimica Acta (2017), 240, 474-485

Ion conducting and paramagnetic d-PCL(530)/siloxane-based biohybrids doped with Mn^{2+} ions, Pereira, R.F.P., **Donoso, J.P.**, **Magon, C.J.,** Silva, I.D.A.,Cardoso, M.A.,Gonçalves, M.C., Sabadini, R.C., Pawlicka, A., de Zea Bermudez, V., Silva, M.M., Electrochimica Acta

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Solid polymer electrolytes based on chitosan and europium triflate, Alves, R.,**Donoso, J.P.**, **Magon, C.J.**, Silva, I.D.A., Pawlicka, A., Silva, M.M. Journal of Non-Crystalline Solids (2016) 432, 307-312.

5. Photonic Glasses (46)

5.1. Luminescent Laser Glasses and Glass-Ceramics

Eu^{3+} and Ce^{3+} co-doped aluminosilicate glasses and transparent glass-ceramics containing gahnite nanocrystals, Dousti, M. Reza; **Molla, Atiar R.**; **Rodrigues, Ana Candida M**.; **de Camargo, Andrea S. S.,** Optical Materials (Amsterdam, Netherlands) (2017), 69, 372-377.

Structure-Property Relations in Fluorophosphate Glasses: An Integrated Spectroscopic Strategy, de Oliveira, Marcos, Jr.; Goncalves, Tassia S.; Ferrari, Cynthia; **Magon, Claudio Jose; Pizani, Paulo S.; de Camargo, Andrea S. S.**; **Eckert, Hellmut**, Journal of Physical Chemistry C (2017), 121(5), 2968-2986.

The Structure of Borophosphosilicate Pure Network Former Glasses Studied by Multinuclear NMR Spectroscopy, Uesbeck, Tobias; **Eckert, Hellmut**; **Youngman, Randall**; **Aitken, Bruce,** Journal of Physical Chemistry C (2017), 121(3), 1838-1850.

Structural Studies of Fluoroborate Laser Glasses by Solid State NMR and EPR Spectroscopies, Zhang, Ruili; de Oliveira, Marcos; Wang, Zaiyang; Fernandes, Roger Gomes; **de Camargo, Andrea S. S.**; **Ren, Jinjun**; **Zhang, Long**; **Eckert, Hellmut,** Journal of Physical Chemistry C (2017), 121(1), 741-752.

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Luminescence quenching versus enhancement in WO_3-$NaPO_3$ glasses doped with trivalent rare earth ions and containing silver nanoparticles, Dousti, M. Reza; Poirier, Gael Y.; Amjad, Raja J.; **de Camargo, Andrea S. S.,** Optical Materials (2016), 60, 331-340.

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Glassy materials and light: part 2, Nalin, Marcelo; Ribeiro, Sidney J. L.; Manzani, Danilo; Goncalves, Rogeria Rocha; Poirier, Gael; Cassanges, Fabia Castro; de Matos, Christiano J. S.; Mendonca, Cleber R.; de Boni, Leonardo; Misoguti, Lino; et al**,** Quimica Nova (2016), 39(3), 340-351.

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Optical and structural properties of Mn^{2+} doped $PbGeO_3$-$SbPO_4$ glasses and glass-ceramics, Volpi, V.; Montesso, M.; Ribeiro, S. J. L.; Viali, W. R.; **Magon, C. J**.; Silva, I. D. A.; **Donoso, J. P**.; **Nalin, M.,** Journal of Non-Crystalline Solids (2016), 431, 135-139.

5.2. Luminescent Hybrid Materials

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5.3. Optical, Photochromic and Photo-thermal Refractive Materials

Lithium diborate glass for high-dose dosimetry using the UV-Vis and FTIR spectrophotometry techniques, de Oliveira, L.N., Schimidt, F., Antonio, P.L., **Andreeta, M.R.B.**, Caldas, L.V.E, Radiation Measurements (2017), in press.

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5.4. Non-Linear Optical Materials.

Highly nonlinear $Pb_2P_2O_7$-Nb_2O_5 glasses for optical fiber production, Manzani, Danilo; Gualberto, Tiago; Almeida, Juliana M. P.; Montesso, Murilo; Mendonca, Cleber R.; Rivera, Victor A. G.; De Boni, Leonardo; **Nalin, Marcelo**; Ribeiro, Sidney J. L.**,** Journal of Non-Crystalline Solids (2016), 443, 82-90.

6. Catalytic Materials (10)

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MONTAZERIAN, M.; **ZANOTTO, E.D.**; Chapter 2: Bioactive Glass-Ceramics: Processing, Properties and Applications, (2017) RSC Smart Materials, 2017 – pp. 27-60.

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PEITL, O.; ZANOTTO, E.D.; MILANI S.B.; SCHELLINI, S.; - IMPLANTE PARA REPOR VOLUME EM CAVIDADES ANOFTÁLMICAS EM HUMANOS OU ANIMAIS, PROCESSO DE OBTENÇÃO DO MESMO, DISPOSITIVO PARA FRESAMENTO DE IMPLANTES E SEU USO. INPI, filed June 2017

ZANOTTO, E.D.; SANTOS G.M.; CROVACCE, M.; - COMPÓSITO VIDRO-MINERAL E PROCESSO DE SINTERIZAÇÃO PARA OBTENÇÃO DE COMPÓSITO VIDRO-MINERAL - INPI, filed on 17/03/2017

c. Oral presentations at international and national conferences:

INTERNATIONAL

A.C. M. RODRIGUES, "Microstructure, compositional effects and ionic conductivity in highly conductive Nasicon glass-ceramics," **International Conference on Advances in Glass Science and Technology (ICAGST-2017),** Kolkatá, India, 23 a 25 de Janeiro, 2017, (Invited talk)

A.C.M. RODRIGUES "Ionic conducting glass and glass-ceramics**", First International symposium on Future Innovative Reliable Materials, Nagaoka University of Technology,** Nagaoka, Japão, 10-11 de março 2017 (Invited)

A.C.M RODRIGUES, "Microstructure, compositional effects, and ionic conductivity relationship in highly conductive Nasicon glass-ceramics (Invited) **12th Pacific Rim Conference on Ceramic and Glass Technology Including Glass & Optical Materials Division Meeting (PacRim12),** Waikoloa, Hawaii, USA, 21 - 26/05/2017"

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NALIN, M., "The effect of silver on the structural and optical properties of thin films in the system $Ag_x(As40S60)100-x$" (oral) **12th Pacific Rim Conference on Ceramic and Glass Technology Including Glass & Optical Materials Division Meeting (PacRim12),** Waikoloa, Hawaii, USA, 21 - 26/05/2017"

NALIN, M., "Optical, Structural and Magnetic Studies of Mn^{2+} Doped $SbPO_4$-ZnO-PbO Glasses" - **ICOOPMA-2016 - International Conference on Optical, Optoelectronic and Photonic Materials and Applications,** Montreal, Quebéc, 12 - 17 June 2016 (Oral)

DE CAMARGO, A. S. S., "Oxyfluoride glass and glass-ceramics doped with Er3+, Yb3+ and Nd3+ for near-infrared applications", em ICTON – **18th International Conference on Transparent Optical Networks,** Trento, Italy, Julho de 2016 (Invited)

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ZANOTTO, E.D.; "The effect of nano heterogeneities (liquid-liquid phase separation) on crystal nucleation in glass-forming silicate liquids" **Turner Legacy symposium,** Sheffield, UK, 01 - 11/09/2016 (Invited)

ECKERT, H., "Chemical Functionalization and intermolecular interactions in nanohybrid Materials: New Magnetic Resonance strategies**"; ICNM-International Conference of Nanomaterials,** Flic-and-Flac, Mauritius, September 7-11, 2016 (Invited)

DE CAMARGO, A. S. S., "Modern hybrid materials for photonic and bioluminescent applications"
ICNM – International Conference on Nanomaterials, Flic-en- Flac, Mauritius, Sept. 2016. (Invited)

ZANOTTO, E.D. – "Glass myths and marvels" - *W. E. S.* Turner Memorial Lecture – delivered during the **Centenary of the Society of Glass Technology, SGT 100**, Sheffield, UK, September 2016 (Plenary talk)

ZANOTTO, E.D., SCHNEIDER. J., ECKERT, H.; "Thirty-year quest for structure/ nucleation relationships in oxide glasses" **MS&T,** Salt Lake City, USA, 21 - 25/10/2016 (Invited)

ZANOTTO, E.D.; "Glass-ceramics: A glorious past and bright future" **MEETING OF LATIN AMERICAN MATERIALS SCIENCE SOCIETY, Cusco, Peru, 27 - 28/10/2016** (Plenary)

DE CAMARGO, A. S. S., Glasses and glass-ceramics. A world without them? em **Brazilian Humboldt Kolleg 2016, Environments: Technoscience and its relation to sustainability, ethics, aesthetics, health and the human future,** São Carlos - SP, Novembro de 2016. (Invited)

NATIONAL MEETINGS

ZANOTTO, E.D. - "Why certain oxide glasses never crystallize?" - **NANOMAT**, March 2017, Brotas, Brazil (Invited)

RODRIGUES A.C.M.; DE CAMARGO, A.S.S., ZANOTTO, E.D.- "Bem Vindo à Era do Vidro: Sólido ou Líquido?" **Pint of Science,** São Carlos, 15/6/2017. (Invited)

ZANOTTO, E.D ; "**Vidro: 6000 anos de tecnologia, ciência e arte**" USP Lectures, Anfiteatro da Congregação da USP, São Paulo, 26/6/2017 (Invited)

GARGARELLA, P.; ANDREETA, M.R.B; RODRIGUES, J.A., BETTINI, S. H. P.; COSTA, L. C. - **Escola de Férias de Engenharia de Materiais para Alunos e Professores do Ensino Médio - EFEM**; Realizado no Departamento de Engenharia de Materiais da UFSCar, em São Carlos, no dia 28/06 a 30/06 de 2017.

FERREIRA, E.B. and ZANOTTO, E.D - "CeRTEV - Um novo paradigma de pesquisas sobre

vidros e vitrocerâmicos", **61º CBC,** Gramado, Junho 2017 (Invited)

ANDREETA, M. R. B., MARCONDES, S.P., "Microstructure design for pure and Nd^{3+}-doped eutectics prepared by laser-heated directional solidification." **XV Encontro da SBPMat, Campinas, SP, 2016**.

GARGARELLA, P.; ANDREETA, M.R.B; RODRIGUES, J.A., BETTINI, S. H. P.; COSTA, L. C. - **Escola de Férias de Engenharia de Materiais para Alunos e Professores do Ensino Médio - EFEM**; Realizado no Departamento de Engenharia de Materiais da UFSCar, em São Carlos, no dia 11/07 a 13/07 de 2016.

ZANOTTO, E.D. "Vidro: 6.000 anos de maravilhas e mitos" **- Ciência às 19horas –** Instituto de Física da USP"**,** 23/08/2016, São Carlos-SP (Invited)

ECKERT, H. New Solid State NMR and EPR Strategies for the Structural Characterization of Photonic Glasses and Glass Ceramics, **Brazilian Meeting in Inorganic Chemistry (BMIC)**, Sao Pedro, Brazil, October 2016 (Invited)

ZANOTTO, E.D. "Maravilhas e mitos do vidro", **SeFís - Semana da Física da UFSCar** – Departamento de Física da UFSCar, 17/10/2016, São Carlos-SP (Invited)

ZANOTTO, E.D. "Propriedades físico-químicas e novas aplicações de vidros**", Jornada da Química e Engenharia Química UNIFRAN,** Franca-SP, 19/10/2016 (Plenary - opening talk)

NALIN, M., "Bem-vindos a era dos vidros, os materiais que estão revolucionando o mundo", **XII Semana da Física da UFSCar** realizado no Departamento de Física Da UFSCar, em São Carlos, no dia 17/10/2016.

NALIN, M., "Bem vindos a era dos vidros", **Semana da Química 2016 - Faculdade de Filosofia Ciências e Letras de Ribeirão Preto- USP**, Ribeirão Preto - USP, 19/10/2016

ZANOTTO, E.D., "Ciências da Engenharia no Brasil: Realizações e Desafios" **Simpósio Comemorativo ao Centenário da ABC – "Desafios para a Ciência e Tecnologia no Brasil**", **FAPESP**, 23/11/2016, São Paulo-SP (Invited)

DE CAMARGO, A. S. S., Materiais híbridos modernos para aplicações fotônicas e Bioluminescentes, em **IV Encontro de Física do Centro Oeste**, Dourados – MS, Novembro de 2016.

MASTELARO, V. R - A Review on Advances in Metal Oxide Semiconductors Materials for Ozone Gas Sensor Application. **In: XV Brazil MRS Meeting,** 2016, Campinas. (Invited)

A.C.M. RODRIGUES, Ionic to Electronic Conductivity in $0.50[xAg_2O(1\text{-}x)V_2O_5]0.50P_2O_5$ Glasses, **XV Brazilian Materials Research Society Meeting,** Campinas, S.P, Brasil 25 a 29 de setembro 2016.

POSTERS Presented ~40

d. Seminars delivered at universities

DE CAMARGO, A. S. S., Mesoporous and nanoscopic hybrid materials for photonic and biophotonic applications University *Global Partnership Network Workshop on New Material &*

Photonics, IFSC/USP, São Carlos – SP, Abril de 2017.

DE CAMARGO, A. S. S., Vidros e vitrocerâmicas laser e materiais híbridos luminescentes: Planejamento, síntese e correlações estruturais-funcionais. Colóquio no IFSC/USP, São Carlos – SP, Abril 2017.

DE CAMARGO, A. S. S., Mesoporous and nanoscopic host-guest materials for photonics and biophotonics. Departamento de Química, Universidad de Chile, Santiago, Chile, Maio de 2017

C.J. Magon – 18/05/2016. Seminar: Electron Paramagnetic Resonance in Nanocomposites. Departamento de Física. Facultad de Ciências, Universidad de Chile.

DE CAMARGO, A. S. S., Modern approaches towards the design of luminescent and photonic materials: Highly emissive molecular species hosted in mesoporous xerogels and glasses. Seminário ao grupo de pesquisa da Prof. Paola Ayala, University of Vienna, Vienna, Austria, Julho de 2016.

ECKERT, H. Chemical Functionalization and Intermolecular Interactions in Inorganic-Organic Hybrid Materials: New Solid State NMR Strategies, University of Vienna, July 2016

DE CAMARGO, A. S. S., Materiais híbridos modernos para aplicações fotônicas e bioluminescentes. IV Encontro de Física do Centro-Oeste, Universidade Federal da Grande Dourados, Dourados – MS, Outubro de 2016.

ECKERT, H., Publish and/or Perish, Modern Perversions of Scientific Publishing, Alexander-von-Humboldt Kolleg, Federal University of Sao Carlos, November 2016.

FERREIRA, E. B., *Technology Roadmapping* (TRM), a CeRTEV course carried out in partnership with the Advanced Innovation Center of the São Carlos Engineering School (EESCIn-USP) aiming to contribute to the planning and management of innovation in the group. EESC-USP, November-December 2016

DE CAMARGO, A. S. S., Propriedades Ópticas de Vidros. Apresentado no LaMaV aos alunos de Engenharia de Materiais, UFSCar, São Carlos – SP, Dezembro de 2016.

e. Conferences, workshops and symposia organized or co-organized by our team

RINO, J. P., Coordenador da XII SeFis, Semana da Física da UFCar, 17-21,Set. 2016

NALIN, M, Co-Chair - XVIII Brazilian Meeting on Inorganic Chemistry and 7th Brazilian Meeting on Rare Earths, Hotel Fazenda Colina Verde, em São Pedro, SP, 25 - 30/09/2016

f. Prestigious CNPq fellowships/grants to the CeRTEV faculty

ECKERT, H., *Bolsa CNPq, Nível 1A*
ZANOTTO, E.D., *Bolsa CNPq, Nível 1A*
PIZANI, P.S., *Bolsa CNPq, Nível 1B*
RINO, J.P. *Bolsa CNPq, Nível 1B*
MASTELARO, V.R., *Bolsa CNPq, Nível 1C*
DE CAMARGO, A. S. S., *Bolsa CNPq, Nível 1D*
SCHNEIDER, J., *Bolsa CNPq Nível 2*
DONOSO J.P., *Bolsa CNPq Nível 2*

g. Research visits

MASTELARO V.R. - 02-04 to 12-4-2017. University of Sydney, Australia. Discussion of results with collaborators.
DE CAMARGO, A. S. S., Department of Chemistry, Universidad de Chile, Maio de 2017.
RODRIGUES, A.C.M, Institut Charles Gerard, Université de Montpellier, Junho de 2017
ECKERT, H. - 18/07-24/07/2017: Department of Physics, Universität Wien, Initiation of Collaborative Work.
NALIN, M. – 12/02-25/02/2016 COPL – Université de Laval, visit and discussion of results and ongoing projects with collaborators
DE CAMARGO, A. S. S., Institute of Physical Chemistry, WWU Münster, Jun.-Jul. de 2016.
DE CAMARGO, A. S. S, Department of Physics, University of Vienna, Julho de 2016.
DONOSO, J.P. – 03/12/2016 a 10/12/2016. Facultad de Ciências, Universidad de Chile. Discussion of results with collaborators.
MAGON, C.J.– 03/12/2016 a 10/12/2016. Facultad de Ciências, Universidad de Chile. Discussion of results with collaborators.

h. International awards and distinctions granted to CeRTEV faculty in the period:

ZANOTTO, E.D**. -** Created by the Materials Research Society of India in 2016 the **"*E.D. Zanotto award in glass science***" - granted annually to the best glass research work presented in their annual meeting by a young researcher

ZANOTTO, E.D. – Delivered the very prestigious "***W. E. S.* Turner Memorial Lecture**" during the centenary of the **Society of Glass Technology, SGT 100**, Sheffield, UK, September 2016. Invited by the Sheffield University Senate.

ZANOTTO, E.D. - Delivered the prestigious "**USP Lecture**" to USP directors, professors, post-docs and invitees. Invited by the USP Research Manager (pró-reitor de pesquisa), São Paulo, Brazil, June 2017.

ZANOTTO, ED. - Named **president** of the Scientific Council of the Serrapilheira Institute (the first private funding agency in Brazil).

i. Titles

ECKERT, H. and FERREIRA, E.B.- LaMaV Fellow, Department of Materials, Federal University of São Carlos, December 2016

ANDREETA, M. R. B. Career progression to Assistant Professor Level III - DEMa-UFSCar, Apr. 2017.

j. Short courses delivered:

ZANOTTO, E.D. - Fundamentals of crystal nucleation and growth in glasses- *SGT Centenary*, Sheffield, Sept. 2016;

RODRIGUES, A.C.M. - Electrical properties of glasses, "International Conference on

Advances in Glass Science and Technology (ICAGST-2017) - Tutorial, Kolkatá, India, 19 a 21 de Janeiro, 2017.

ECKERT, H. - Introduction into Solid State NMR, MaMaSELF Master Course, University of Montpellier, February 2017.

DE CAMARGO, A. S. S. - Espectroscopia óptica aplicada à caracterização de materiais", Minicurso XI Semana Acadêmica de Química UTFPR, Curitiba – PR, Junho de 2017.

DONOSO J.P., MAGON, C. - Electron Paramagnetic Resonance, Lectures delivered at the Advanced School on Magnetic Resonance Primeira Escola Brasileira de Ressonância Magnética, Organização: Associação de Usuários de Ressonância Magnética (AUREMN), 1 a 10 Fevereiro 2017, IFSC/USP São Carlos - SP, *(70 foreign and 50 Brazilian attendees)*

k. Editorship of scientific journals

ECKERT, H. - **Editor-in-chief, Solid State Nuclear Magnetic Resonance (Elsevier**)
ECKERT, H. - **Editorial Board Member, Zeitschrift für Naturforschung, (Physics)**

ANDREETA, M.R.B. - **Associate Editor: Open Chemistry Journal (ISSN: 1874-8422)**

MASTELARO, V. - **Member of the Editorial Commission of Materials Research: Ibero-american Journal of Materials**

RODRIGUES, A.C.M. - **Associate Editor, Frontiers in Materials: Glass Science**

ZANOTTO, E. D. - **Editor of the Journal of Non-Crystalline Solids**
ZANOTTO, E. D. - **Guest editor of the MRS Bulletin and Journal of Materials Science**
ZANOTTO, E. D.- **Member of the International Advisory Boards of: International Journal of Applied Glass Science (USA), Materials Research (Ibero-American), Buletin de la Sociedad Espanhola de Ceramica y Vidrio (Spain), Biomedical Glasses (Germany), Iranian Journal of Materials Science and Engineering (Iran), Cerâmica (Brazil)**

l. Administrative and consulting role in scientific societies

DE CAMARGO, A. S. S. – Membro do Grupo de Trabalho sobre Questões de Gênero (GTG), Sociedade Brasileira de Física **SBF**, 2015 – 2018.
DE CAMARGO, A. S. S. – Membro do Conselho, **Clube Humboldt do Brasil**, 2016.

RODRIGUES, A.C.M. – Secretary of the **ICG TC23:** Education in Glass

NALIN, M. - Member of the **ICG TC20**: Optoelectronics

ECKERT, H. - Advisory Board member, Network of the French High-Field NMR Facilities
ECKERT, H. – Hans - Hellmuth Vits-Prize Committee, Society of the **WWU Münster**
ECKERT, H. - Awards Committee, **European Research Council**
ECKERT, H. - Georg-Forster Prize Committee, **Alexander-von-Humboldt Foundation**
ECKERT, H. - Georg-Forster Fellowship Selection Committee, **Alexander-von-Humboldt Foundation**
ECKERT, H. - Selection Committee, **Humboldt/CAPES** Postdoctoral Fellowship Program

FERREIRA, E. B. – Glass Committee of the Brazilian Ceramic Society

ZANOTTO, E.D**. - President** of the Scientific Council of the **Serrapilheira Institute**
ZANOTTO, E.D. - Chair of the **GOMD** of the American Ceramic Society
ZANOTTO, E.D. - Board of Directors of the **Brazilian Ceramic Society**
ZANOTTO, E.D. - Member of the Glass Crystallization and GC Committee: **ICG TC07**
ZANOTTO, E.D. - Council member of the **International Commission on Glass**
ZANOTTO, E.D. - Council member of the **International Ceramic Federation**
ZANOTTO, E.D. - Curator of the São Carlos **Tech Parq Foundation**
ZANOTTO, E.D. - Council member of IMPA (**Institute of Mathematics**), Brazil
ZANOTTO, E.D. - TAB member of O-I, USA
ZANOTTO, E.D. - Engineering Fellowship Selection Committee, **TWAS**
ZANOTTO, E.D. - G.W. Morey Award Selection Committee, **GOMD - ACERS**
ZANOTTO, E.D. - Gottardi Prize, Voting Committee, **ICG**
ZANOTTO, E.D. - Zachariasen and Mott Awards, Selection Committee, **JNCS**

m. On Going and Finished MSc Dissertations on Vitreous Materials (12)

Advisor: Ana Candida Martins Rodrigues
Juan Jairo Diaz Marin (Capes, finished)
Manoel da Cruz Barbosa Neto (Capes)

Advisor: Andrea S. S. de Camargo
Allyson Jorge dos Santos (conluded, 2016, no grant)
Priscila França Guidini (ongoing, 2016, no grant)

Advisor: Edgar Dutra Zanotto
André Hofmeister Martins Serra (no grant)
Martha Velasco Velasco (CAPES)

Advisor: Eduardo Bellini Ferreira
Guilherme da Silva Macena (ongoing, 2017, CNPq)
Johnata Cavalcanti (ongoing, 2017, CAPES)

Advisor: Marcelo Nalin
Samira Stain (Bolsa Verescence)

Advisor: Marcello Rubens Barsi Andreeta
Angela Santana Nunes (no grant)
Leonardo Vieira Albino (bolsa CAPES)

Advisor: Valmor R. Mastelaro
Yajaira Dalila Rivero Jerez (October/2015 – bolsa CNPq)

n. On going and finished PhD students (36)

Advisor: Ana Candida Martins Rodrigues
Adriana Nieto Muñoz (CNPq)
Jairo Felipe Ortiz Mosquera (Capes)
Rafael Bianchini Nuernberg (CNPq)
Caio Barca Bragatto (finished – bolsa CAPES)

Advisor: Andrea S. S. de Camargo
Tássia de Souza Gonçalves (Out. 2014 - Set. 2018 - bolsa CAPES)

Advisor: Edgar Dutra Zanotto
Claudia Patrícia Marin Abadia (CAPES)
Gisele Guimarães dos Santos (CAPES)
Jeanini Jiusti (co-advisor with Andreeta, CNPq)
Laís Dantas Silva (CNPq)
Maria Helena Ramirez Acosta (CAPES)
Milena Félix dos Santos (CAPES)
Mina Eilaghi (bolsa CAPES)
Renato Luis Siqueira (co-advisor w Peitl - CAPES)
Leonardo Sant'Ana Gallo (finished, co advisor w A Rodrigues- FAPESP)

Advisor: Eduardo Bellini Ferreira
Laerte Melo Barros (finished, 2016, IFAM-Manaus)
Roger Gomes Fernandes (finished, 2017, FAPESP)
Marcelo Gomes Bacha (finished, 2017, CAPES)
Raúl Julián Revelo Tobar (ongoing, 2014, CAPES)

Advisor: Hellmut Eckert
Carsten Doerenkamp (finished - DFG)
Henrik Bradtmüller (DFG)
Lena Funke (German Business Foundation/BMBF)
Tobias Uesbeck (finished - DFG)

Advisor: José Pedro Rino
José Vitor Michelin (CAPES)

Advisor: José Pedro Donoso Gonzalez
Igor d`Anciães Almeida Silva (CAPES)
Eduar Enrique Carvajal Taborda (co-orientador - CAPES)

Advisor: Marcelo Nalin
Antônio Eduardo de Souza (CAPES)
João Fernando Villarrubia Munhoz (CNPq)
Juliana Moreno de Paiva (CNPq)
Juliane Resges Orives (CNPq)
Leonardo V. Albino (MSc) (CNPq)
Maira Resende (finished)
Samira Stain (MSc) (bolsa SGD-Vidros)

Advisor: Paulo Sérgio Pizani
Renilton Correa da Costa (finished in 2017 – CAPES)
Thiago Rodrigues da Cunha (CAPES)

Advisor: Valmor R. Mastelaro
Paulo Sérgio Bayer, Period: 2013 (no grant)

Advisor: Oscar Peitl
Simone Brandão Milani - Medicina UNESP Botucatu (finished)

o. Current + Finished Post-Doctoral Fellows Working on Vitreous Materials (20)

Ana Candida Martins Rodrigues:
Swarup Kundu (CAPES)

Advisor: Andrea S. S. de Camargo

Mohammad Reza Dousti (finished - FAPESP)
Rajesh Dagupati (bolsa FAPESP, ongoing)

Advisor: Edgar Dutra Zanotto
Alisson M. Rodrigues (CAPES)
Daniel Roberto Cassar (CNPq, pending)
Mariana Carlos de Oliveira Villas Bôas (finished)
Marina Trevelin Souza (FAPESP)
Maziar Montazerian (FAPESP)
Murilo Camuri Crovace (FAPESP)

Advisor: Eduardo Bellini Ferreira
Maria Costa (FAPESP, jointly with **Hellmut Eckert**)

Advisor: Hellmut Eckert
Camila Borgognoni (proposal pending (CNPq))
Bianca Cerrutti (proposal pending (FAPESP))
Marcos de Oliveira Junior (FAPESP)
Maria Costa (FAPESP, jointly with Eduardo Bellini Ferreira)

Advisor: Paulo Sérgio Pizani
Benjamin John Albert Moulton (FAPESP)

Advisor: Marcelo Nalin
Douglas Faza Franco (PNPD-CAPES)
Hssen Fares (FAPESP)

Advisor: José Pedro Rino
Ary Rodrigues Ferreira Jr. (FAPESP)
David Vieira Sampaio (co-advisor w Pizani, FAPESP)
Luis Gustavo V. Gonçalves (finished – FAPESP)
Rolando Placeres Jimenez – (finished – FAPESP)

p. Current undergraduate (internship) research students (32)

Advisor: Ana Candida Martins Rodrigues
Amanda Daniele Fulanetto (no grant)
Gabriel Buzatto de Souza (CAPES)
Laura Emi Tavoni Mathias (FAPESP)
Lucas de Almeida Silva (no grant)

Advisor: Andrea S. S. de Camargo
Rodolfo Zavan – PIBIC/CNPq (ongoing, 2016)

Advisor: Edgar Dutra Zanotto
André Luchetti Cortada (FAPESP)
Anelise Simões Sampaio (FAPESP)
Heloisa Daltoso Orsolini (PIBIC)
Lucas Pitaluga (PIBIC, under review)
Matheus Mattos (Serrapilheira)
Nicoli Bortolin Lucci (no support**)**
Ricardo Felipe Lancelotti (FAPESP)
Rodrigo Cardoso dos Passos (Serrapilheira)

Vinicius Esteves Torres (PIBIC, finished)
Fatima Tiemi Yoskigawa (FAPESP, finished)
Nickson Costa Ribeiro (no support, finished)

Advisor: Eduardo Bellini Ferreira
Arthur Henrique Perina Sampaio (PIBIC/USP, under review)
Vitor Zoega Martins Fonseca (PIBIC/USP, under review)
Vitória Monteiro Dias (PIBIC/USP, under review)

Advisor Hellmut Eckert
Adriana Araújo Almeida (no support)

Advisor: José Fabián Schneider
Davi Arrais Nobre (PIBIC/USP)
Gabriel Felipe Morguetto (PUB/USP)

Advisor: Marcelo Nalin
Caio Mathias (no grant)
Carolina Alice Schulmman (pending FAPESP)
Felipe Pellarigo (pending FAPESP)
Rafaela Pereira (CNPQ-PIBIC)
Ricardo Baltieri (FAPESP)

Advisor: Marcello Rubens Barsi Andreeta
Thiago Belaz Silva
Marcelo Azanha (finished)

Advisor: Paulo Sérgio Pizani
Rafaella Bartz Pena (FAPESP)
Renan Beloti Bonini - (no support)

Advisor: Valmor R. Mastelaro
João Vitor Marçola (Pending - PIBIC)

q.Visiting Professors

Doris Möncke – Jena, Germany, (FAPESP 5 months)
Joachim Deubener – Clausthal, Germany, (FAPESP 5 months, concluded)
Mohammad Reza Mohammadi (FAPESP, concluded Oct. 2016)
Raja Junaid Amjad (FAPESP, concluded Dec. 2016)
Vladimir M. Fokin – St. Petersburg, Russia, 12 months
Dr Guillermo A. González Moraga, Professor Titular da Universidad de Chile. Visita ao Laboratorio de Ressonância Magnética, Instituto de Física de São Carlos, USP, 16 a 21 de janeiro de 2017
Dra. Eglantina Benavente, chefe do Departamento de Química da Universidade Tecnologica Metropolitana, Santiago, Chile. Visita ao Laboratorio de Ressonância Magnética, Instituto de Física de São Carlos, USP, 16 a 21 de janeiro de 2017
Dra. Maria Manuela Silva Pires. Universidade do Minho, Braga, Portugal. Visita ao Laboratorio de Ressonância Magnética, Instituto de Física de São Carlos, USP, janeiro de 2017
Dr. Ricardo Costa Santana, Instituto de Física, Universidade Federal de Goiás, Campus Samambaia, Goiânia, Visita ao Laboratório de Ressonância Paramagnética do IFSC-USP para realização de medidas e discussão de resultados, 16-21, Abril, 2017

r. Voluntary activities within the respective universities

DE CAMARGO, A. S. S. - Vice-Presidente Comissão de Pesquisa IFSC - 05/16 - ...
DE CAMARGO, A. S. S. - Membro da Comissão de Pós Graduação Ciência e Engenharia de Materiais, EESC/USP - 08/14 - .....
DE CAMARGO, A. S. S. - Membro da Comissão Coordenadora do Curso de Bacharelado em Química, IQSC/USP - 03/17 - ...
DE CAMARGO, A. S. S. - Membro do Conselho de Depto. Física e Ciência Interdisciplinar, IFSC/USP – Maio/16 -..... (2 anos)

ECKERT, H. - Vice Chefe do Departamento da Física e Ciência Interdisciplinar, Maio/16-….2 anos.
ECKERT, H. – Vice-Presidente Comissão Relações Internacionais (CRINT)
ECKERT, H.- Membro do Conselho de Depto. Física e Ciência Interdisciplinar, IFSC/USP.
ECKERT, H. - Membro da congregação do Instituto de Física São Carlos (IFSC), USP.

NALIN, M. – Vice-Chefe do Departamento de Química Geral e Inorgânica do IQ-UNESP – Araraquara (2015-2016)
NALIN, M – Membro da congregação do IQ-UNESP – Araraquara (2014-atual)
NALIN, M – Representante do IQ-UNESP no Conselho Universitário da UNESP- (11/2016-atual)
NALIN, M – Suplente no Conselho de Curso da Engenharia Química – IQ-UNESP (2016-2018)
NALIN, M – Suplente no Conselho de Curso da Engenharia Bioprocessos – Farmácia-Bioquímica-UNESP (2016-2018)
NALIN, M – Titular na Comissão Permanente de Administração- CPAD– IQ-UNESP (2016-2018)
NALIN, M, Diretor Administrativo – FACTE – Fundação de Apoio a Ciência, Tecnologia e Educação (2014-atual)

FERREIRA, E.B. - Membro Titular do Conselho do Departamento de Engenharia de Materiais, EESC/USP, 05/2015 – 2017.
FERREIRA, E.B. - Membro Suplente do Conselho do Departamento de Engenharia de Materiais, EESC/USP, 2017 – atual.
FERREIRA, E.B. - Representante Suplente do Departamento de Engenharia de Materiais junto à Comissão de Cultura e Extensão Universitária, EESC/USP, 12/2014 – 2016.
FERREIRA, E.B. – Membro do Conselho Deliberativo do Centro de Engenharia Aplicada à Saúde (CEAS), EESC/USP, 09/2013 – Atual.
FERREIRA, E.B. - Membro Suplente da Comissão Coordenadora do Programa (CCP) de Pós-Graduação Ciência e Engenharia de Materiais, EESC/USP, 02/2013 – 2016.
FERREIRA, E. B. – Suplente da Comissão de Pesquisa, EESC/USP, 2017 - Atual

ZANOTTO, E.D. - Member of the Research Council (CoP) of UFSCar since 2013.
ZANOTTO, E.D. - Member of the committee for evaluation of faculty performance, PPGCEM/ UFSCar, 2015 – Present.
ZANOTTO, E.D- Vice-chair of the Ceramics Area of DEMa / UFSCar
ZANOTTO, E.D- Supervisor of the LaMaV / UFSCar

ANDREETA, M. R. B. - Membro suplente da Coordenadoria de Iniciação Científica e Tecnológica (CCET - Campus São Carlos), 2014-2016.
ANDREETA, M. R. B. - Coordenador da Área de Materiais Cerâmicos do Departamento de Engenharia de Materiais (CCET - UFSCar), 2015-2016.
ANDREETA, M. R. B. - Membro do Núcleo Docente Estruturante (NDE) do curso de Graduação em Engenharia de Materiais da Universidade Federal de São Carlos, 2015 - 2016.
ANDREETA, M. R. B. - Membro do Conselho do Departamento de Engenharia de Materiais,

DEMA/UFSCar (2015-2016).
ANDREETA, M. R. B. - Coordenador da atividade de extensão: ACIEPE - "Engenheiros e Cientistas do Futuro" oferecida semestralmente (4 créditos).

SCHNEIDER, J.F. – Coordenador do Curso de Bacharelado em Física, Instituto de Física de São Carlos/USP, 2016 – atual.
SCHNEIDER, J.F. – Membro da Comissão de Graduação, Instituto de Física de São Carlos/USP, 2016 – atual.

RINO, J.P. – Membro titular representante do CCET para avaliação e desempenho acadêmico dos docentes.

MASTELARO VR- Coordenador do Grupo Crescimento de Cristais e Materiais Cerâmicos-IFSC/USP desde 2007.
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MAGON, C.J. - Membro efetivo representante Professores Associados no Conselho do FCI/IFSC/USP IFSC/USP (2016-2017).

7. Appendix - Publications 2013 - June 2017

Fundamentals of Glass Structure and Crystallization

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Summary 2013-2017:

General Glass and Crystallization:	**28**
Techniques	**12**
Strong Ceramics	**5**
Bioglasses	**31**
Energy Storage/electrical	**24**
Photonic Materials	**45**
Catalytic Systems	**9**

Total Number of Publications: 154 (about 11 per member, 17 per PI)
Papers with collaboration within CeRTEV: 52 (34 %)
Papers with international collaborators: 42 (27 %)
Papers with collaborations within CeRTEV plus international collaboration 7 (5 %)
Papers with 3 or more CeRTEV collaborators: 14 (10 %)

Board member Co-authorships:
joint publications with 10 board members

Fokin	**12**
Schmelzer	**7**
Zhang	**4**
Boccacini	**3**
Pradel	**2**
Yue	**2**
Glebov	**1**
Aitken	**1**
Davis	**1**
Carlos	**1**

8. Descrição sucinta e justificada da aplicação dos recursos de Reserva Técnica e Benefícios Complementares no período coberto pelo Relatório

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

TRANSPORTE

DESCRIÇÃO	VALOR	DATA DE EMISSÃO	JUSTIFICATIVAS
Passagens aéreas/Mauritius	R$ 3.997,53	15/6/16	Transporte aéreo para Profa. Andrea participar do 2nd ICNM2016 - International Conference on NanoMaterials, apresentando o trabalho entitulado: "Modern hybrid materials for photonic and bioluminescent applications" no Sofitel Imperial Resort & Spa at Flic in Flac in Mauritius, no período de 6 a 10/09/2016
Passagens aéreas/Mauritius	R$ 3.997,53	15/6/16	Transporte aéreo para Prof. Hellmut participar do 2nd ICNM2016 - International Conference on NanoMaterials, apresentando o trabalho entitulado: "Chemical functionalization and intermolecular interactions in nanohybrid materials: New Magnetics Resonance Strategies" no Sofitel Imperial Resort & Spa at Flic in Flac in Mauritius, no período de 6 a 10/09/2016
Passagens de trem - Muenster/Trento	R$ 914,45	13/6/16	Transporte de trem para Profa.Andrea participar do 18th International Conference on Transparent Optical Networks em Trento - Itália no período de 10 a 14/07/2016
Passagens aéreas Sheffield	R$ 5.031,46	21/9/16	Transporte aéreo para Prof. Edgar apresentar trabalho científico como invited speaker entitulado: "The effect of nanoheterogeneities (liquid-liquid phase separation) on crystal nucleation in glass-forming silicate liquids" no "Turner Legacy Symposium" em Sheffield, UK, no período de 01 a 11/09/2016
Passagens de trem Sheffield	R$ 198,12	14/9/16	Transporte de trem para Prof. Edgar apresentar trabalho científico como invited speaker entitulado: "The effect of nanoheterogeneities (liquid-liquid phase separation) on crystal nucleation in glass-forming silicate liquids" no "Turner Legacy Symposium" em Sheffield, UK, no período de 01 a 11/09/2016
Passagens aéreas India - Congresso	R$ 5.319,48	7/12/16	Transporte aéreo para Profa. Ana Candida participar do "ICAGST 2017 – Advances in Glass Science and Technology", e no "tutorial" (mini-curso) que o precede. No tutorial, apresentou a palestra "Electrical properties of glasses", e na conferência um invited talk intitulado "Microstructure, compositional effects and ionic conductivity in highly conductive Nasicon glass- ceramics", realizados em Kolkatá, India, de 19 a 25 de Janeiro de 2017
Passagens aéreas Curitiba/PR - Congresso Brazglass	R$ 463,06	10/4/16	Passagem aerea para Profa. Andrea Camargos participar do BRAZGLASS - Brazilian Symposium on Glasses no qual é palestrante convidada.
Passagens aéreas Curitiba/PR - Congresso Brazglass	R$ 463,06	11/4/16	Transporte aéreo para Prof. Hellmut para participação do XI Brazilian Symposium on Glass and Related Materials no período de 13 a 16/07/2017 em Curitiba-PR
Passagens aéreas GRU-SP/SVO-Moscou/GRU-SP	R$ 3.554,93	10/7/16	Transporte aéreo Prof. Marcelo Nalin para participar do "XX International Symposium on Non-Oxide and New Optical Glasses (ISNOG-2016)",)" realizado no período de 21 a 26/08/2016 realizado em Nizhny Novgorod, Rússia
Passagem aérea SP/Kona/SP - 19 a 27/05/2017	R$ 5.453,91	9/3/17	Transporte aéreo Prof. Marcelo Nalin participar do 12th Pacific Rim Conference on Ceramic and Glass Technology (PacRim12), no período de 21 a 26/06/2017 em Waikoloa, Hawaii, USA
Pedágio Índia	R$ 88,00	3/5/17	Pagamento de pedágio para Profa. Ana Candida participar do "ICAGST 2017 – Advances in Glass Science and Technology", e no "tutorial" (mini-curso) que o precede. No tutorial, apresentou a palestra "Electrical properties of glasses", e na conferência um invited talk intitulado "Microstructure, compositional effects and ionic conductivity in highly conductive Nasicon glass- ceramics", realizados em Kolkatá, India, de 19 a 25 de Janeiro de 2017
Passagens aéreas Congresso Londres	R$ 7.895,00	5/5/17	Transporte aéreo para Prof. José Fabian Schneider participar do "Borate Glasses, Crystals & Melts 9 and Phosphate Materials 2017" em Oxford
Passagens aéreas Quebec/Canadá - Congresso	R$ 4.649,00	26/5/17	Transporte aéreo para Prof. Hellmut Eckert para participar no congresso ISMAR, Quebec, Julho 24-28/2017
Passagens aéreas - 04 a 07/06/2017 - Guarulhos/PA/Congonhas	R$ 688,00	12/6/17	Aquisição de passagem aérea para participação do prof. Eduardo B. Ferreira no 61 Cogresso da ABCeram, 2017.

SERVIÇO DE TERCEIROS

DESCRIÇÃO	VALOR	DATA DE EMISSÃO	JUSTIFICATIVAS
Seguro saúde	R$ 77,50	20/7/16	Seguro saúde para Prof. Edgar Dutra Zanotto participar de reunião técnica na Owens-Illinois World Headquartes- Meeting of the Technical Advisory Board, TAB, Perrysburg, USA, no período de 25 a 29/07/2016
Seguro saúde Sheffield	R$ 170,50	24/8/16	Seguro saúde para Prof. Edgar apresentar trabalho científico como invited speaker entitulado: "The effect of nanoheterogeneities (liquid-liquid phase separation) on crystal nucleation in glass-forming silicate liquids" no "Turner Legacy Symposium" em Sheffield, UK, no período de 01 a 11/09/2016

Taxa de inscrição "XV Brazilian MRS Meeting"	R$ 850,00	25/8/16	Pagamento de taxa de inscrição de Profa. Ana Candida M. Rodrigues para participação do XV Brazilian MRS Meeting apresentar o trabalho entitulado "IONIC TO ELECTRONiC CONDUCTIVITY IN O.50[xA920(1-x)V20slO.50P20s GLASSES" em Campinas-SP de 25 a 29/09/2016
Inscrição Congresso Nizhny Novgorod/Rússia de 21 a 26/08/2016	R$ 984,42	27/7/16	Pagamento de taxa de inscrição Prof. Marcelo Nalin para participar do "XX International Symposium on Non-Oxide and New Optical Glasses (ISNOG-2016)",)" realizado no período de 21 a 26/08/2016 realizado em Nizhny Novgorod, Rússia
Inscrição Congresso XVIII BMIC - São Pedro/SP	R$ 1.000,00	25/9/16	Pagamento de taxa de inscrição para Prof. Marcelo Nalin participar do XVIII BMIC -Brazilian Mee ing on Inorganic Chemistry and 7th Brazilian Meeting on Rare Eertbs, held a Hotel Colina Verde, no período de 25 a 30/09/2016 em São Pedro - SP.
Taxa de inscrição Borate Glasses, Crystals & Melts 9 and Phosphate Materials 2	R$ 2.095,00	5/5/17	Pagamento taxa de inscrição para Prof. José Fabian Schneider articipar do "Borate Glasses, Crystals & Melts 9 and Phosphate Materials 2017" em Oxford no período de 24 a 28/07/2017
Inscrição Ana Candida - XI Brazilian Symposium on Glass and Related Materials	R$ 720,00	31/5/17	Pagamento de taxa de inscrição para Profa. Ana Candida participar do XI Brazilian Symposium on Glass and Related Materials em Curitiba-PR de 13 a 16/07/17
Inscrição PACRIM 12 - (PARTE DO VALOR EM B.C. E PARTE EM R.T.)	R$ 1.850,49	29/6/17	Pagamento taxa de inscrição para Profa. Ana Candida Martins Rodrigues apresentar um "invited talk" intitulado "Microstructure, compositional effects, and ionic conductivity relationship in highly conductive Nasicon glass-ceramics", no 12th Pacific Rim Conference on Ceramic and Glass Technology (PacRim12), e trabalho oral intitulado "Ionic to electronic conductivity in 0.50[xAg2O(1-x)V2O5]0.50P2O5 glasses" no congresso paralelo, Glass & Optical Materials Division Meeting, ambos realizados em Waikoloa, Hawaii, USA, de 21 a 26 de maio.
		DIÁRIAS	
DESCRIÇÃO	**VALOR**	**DATA DE EMISSÃO**	**JUSTIFICATIVAS**
Diárias 10 a 14/07/16 - Trento/Itália	R$ 3.209,20	1/7/16	Diárias para Profa.Andrea participar do 18th International Conference on Transparent Optical Networks em Trento - Itália no período de 10 a 14/07/2016
Diárias Sheffield de 01 a 11/09/2016	R$ 4.694,40	3/8/16	Diárias para Prof. Edgar apresentar trabalho científico como invited speaker entitulado: "The effect of nanoheterogeneities (liquid-liquid phase separation) on crystal nucleation in glass-forming silicate liquids" no "Turner Legacy Symposium" em Sheffield, UK, no período de 01 a 11/09/2016
Diárias Perrysburg de 25 a 29/07/2016	R$ 1.625,30	3/8/16	Diárias para Prof. Edgar Dutra Zanotto participar de reunião técnica na Owens-Illinois World Headquartes- Meeting of the Technical Advisory Board, TAB, Perrysburg, USA, no período de 25 a 29/07/2016
Diárias Congresso Nizhny Novgorod/Rússia de 21 a 26/08/2016	R$ 4.875,90	3/8/16	Diárias Prof. Marcelo Nalin para participar do "XX International Symposium on Non-Oxide and New Optical Glasses (ISNOG-2016)",)" realizado no período de 21 a 26/08/2016 realizado em Nizhny Novgorod, Rússia
Diárias 04 a 11/09/16 - Congresso Mauritius	R$ 3.215,70	23/8/16	Diárias para Profa. Andrea participar do 2nd ICNM2016 - International Conference on NanoMaterials, apresentando o trabalho entitulado: "Modern hybrid materials for photonic and bioluminescent applications" no Sofitel Imperial Resort & Spa at Flic in Flac in Mauritius, no período de 6 a 10/09/2016
Diárias 04 a 11/09/16 - Congresso Mauritius	R$ 3.215,70	23/8/16	Diárias para Prof. Hellmut participar do 2nd ICNM2016 - International Conference on NanoMaterials, apresentando o trabalho entitulado: "Chemical functionalization and intermolecular interactions in nanohybrid materials: New Magnetics Resonance Strategies" no Sofitel Imperial Resort & Spa at Flic in Flac in Mauritius, no período de 6 a 10/09/2016
Diárias 18 a 19/10/2016 - Congress ABCERAM	R$ 530,00	20/10/16	Diárias para participação do prof. Eduardo B. Ferreira no 60 Cogresso da ABCeram, 2016.
Diárias para participação no Internacional Conference on Advances in Glass Science and Technology	R$ 3.220,50	30/1/17	Diárias para Profa. Ana Candida participar do "ICAGST 2017 – Advances in Glass Science and Technology", e no "tutorial" (mini-curso) que o precede. No tutorial, apresentou a palestra "Electrical properties of glasses", e na conferência um invited talk intitulado "Microstructure, compositional effects and ionic conductivity in highly conductive Nasicon glass- ceramics", realizados em Kolkatá, India, de 19 a 25 de Janeiro de 2017
Diárias Araraquara/Havaí/Araraquara - 20 a 27/05/2017	R$ 4.362,99	5/4/17	Diárias Prof. Marcelo Nalin participar do 12th Pacific Rim Conference on Ceramic and Glass Technology (PacRim12), no período de 21 a 26/06/2017 em Waikoloa, Hawaii, USA
Diárias 04 a 08/06/2017 - Gramado/RS	R$ 1.080,00	12/6/17	Diárias para participação do Prof. Eduardo B. Ferreira 61 o Congresso Brasileiro de Cc-rân rica, no período de 04 a 07 de Jun ho de 2017 em Gramado - RS

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

MATERIAL DE CONSUMO

DESCRIÇÃO	VALOR	NOTA FISCAL	DATA DE EMISSÃO	JUSTIFICATIVAS
Contador, relé térmico	R$ 344,12	248.679	3/6/16	Material elétrico para construção e conserto do sistema de refrigeração de água para os eletroimas do EPR
Contador, relé térmico	R$ 156,43	248.879	6/6/16	Material elétrico para construção e conserto do sistema de refrigeração de água para os eletroimas do EPR
Mangueira Bor 1 AR-água	R$ 206,31	5.534	9/6/16	Material hidraulico para construção e conserto do sistema de refrigeração de água para os eletroimas do EPR
2 jogos de serra copo para madeira	R$ 74,47	50.339	10/6/16	Ferramenta para uso rotineiro no laboratório de EPR
Bateria Unipower 12V	R$ 540,00	2080	11/7/16	Troca de bateriais e manutenção de no-break que sustenta os equipamentos de análise térmica e UV-Vis
Pen drive 32GB Sandisk	R$ 110,00	381	13/7/16	Acessório informática para computador do LaMaV
Broxa retangular, lencol borracha	R$ 305,54	6022	15/7/16	Material adquirido para composição do cenário de exposição do Espaço Ventura
Lamp flu led, RCG lum	R$ 103,94	253.816	15/7/16	Material adquirido para composição do cenário de exposição do Espaço Ventura
Toner HP CB436	R$ 120,00	2424	18/7/16	Toner para impressora do laboratório
Diesel	R$ 330,01	33.064	29/7/16	Diesel para abastecimento de gerador de energia
Caixa organizadora, caixa org. c/ alça	R$ 203,46	30.440	4/8/16	Material adquirido para armazenagem e carregamento adequado das exposições do Espaço Ventura
Bastão madeira 7/8 105cm	R$ 8,00	2356	6/8/16	Material adquirido para composição do cenário de exposição do Espaço Ventura
Vinil all tak, metal 1,38 mt, vinil gold, etc	R$ 141,00	2355	6/8/16	Material necessário para composição de cenários teatrais e exposições do Espaço Ventura
Cilindro 50L +/- 4% OS 200Bar D.232 AC2 1470m	R$ 2.600,00	278.744	10/8/16	1 cilindro (vasilhame) de alta pressão para gás argônio-hidrogênio, de 10m3. Para operar de forma permanente, durante o processo de regeneração, junto com a glove-box da MBraun, equipamento adquirido com verba deste projeto. - 1 cilindro (vasilhame) de alta pressão para gás argônio, de 10m3. Para operar de forma permanente junto com a glove-box da MBraun, equipamento adquirido com verba deste projeto
Trasf E-110 S-220V	R$ 36,90	21.587	10/8/16	Adaptação de voltagem para uma balança analítica de 220V para a linha de 110V usada dentro da glove box MBRANU de 100V
Daisa tampa, daisa uni reto, etc.	R$ 220,59	257.435	16/8/16	Material necessário para construção de cenários teatrais e exposições do Espaço Ventura
Cartuchos de tinta originais	R$ 450,00	2453	18/8/16	Cartuchos de tinta para impressora do laboratório
Fluxometro, mangueira trancada 3/8, regulador, etc.	R$ 4.270,00	827	18/8/16	Fluxometro para regulação da entrada da câmera seca com fluxo contínuo de nitrogênio. Equipamento utilizado durante a preparação e manuseio de amostras com sensibilidade média à umidade/Mangueiras trançadas de 1 e 3/8 de polegada para entrada de gases de operação da glove-box da MBraun, equipamento adquirido com verba deste projeto / Regulador de pressão de argônio-hidrogênio (DL215/8), para operar de forma permanente junto a cilindro de gás comprimido de regeneração da glove-box da MBraun, equipamento adquirido com verba deste projeto/ Regulador de pressão de argônio (DL215/3), para operar de forma permanente junto aos cilindro de gás comprimido da glove-box da MBraun, equipamento adquirido com verba deste projeto.
Pistola - cola silicone, cola - refil silicone	R$ 86,50	1460	19/8/16	Material necessário para construção de cenários teatrais e exposições do Espaço Ventura
placa de desenvolvimento, termometro	R$ 260,00	13153	30/8/16	Microprocessador arduino e sensor térmico para controle do espectrômetro de EPR
Silicone tubo	R$ 106,50	70.466	5/9/16	15m de mangueira de silicone (diâmetros interno e externo 4 e 8mm) para susbtituição de mangueiras de saída de hélio e nitrogênio gasosos do magneto supercondutor de 8 Tesla
Cabo extensor P2/P2, microfone pedestal preto	R$ 35,85	40.614	14/9/16	Acessórios de informática para o laboratório
Modulo isolador moduline, fonte fortrek	R$ 245,70	40.639	15/9/16	Acessórios de informática para o laboratório
Pass vinilica, plast poliester, etc	R$ 1.705,10	615	15/9/16	Material necessário para composição de cenários teatrais e exposições do Espaço Ventura
Conversor HDMI X VGA Maxprint	R$ 58,00	1020	16/9/16	Acessórios de informática para o laboratório
Diesel	R$ 389,21	34.991	4/10/16	Diesel para abastecimento de gerador de energia
Placa PCI express com duas portas serial	R$ 159,88	51.108	5/10/16	Acessórios de informática para o laboratório
Carretel vazio, controlador temp., fio RK	R$ 1.067,50	2125	5/10/16	Confecção de resistências eletrétricas para forno de tratamento térmico
Controlador processo C705+RS485	R$ 946,57	81.439	7/10/16	Controlador de temperatura para substituição em módulo de potência de forno para tratamento térmico
Luva de algodão punho longo tam. M e G	R$ 421,40	378	11/10/16	Luvas de algodão antialérgico de vários tamanhos e comprimentos (M e G, punho curto e longo) para uso durante a operação da glove-box, evitando o contato da pele com a luva de butila da câmera e absorvendo o suor
Pilha palito Panasonic c/ 4	R$ 22,50	1566	20/10/16	Insumos para materiais eletrônicos
Bateria	R$ 4.800,00	4693	21/10/16	Baterias de automóvel para utilização em nobreak
Anel oring, fita crepe, fita isolante, etc.	R$ 216,51	7659	28/10/16	Materiais para uso diário no laboratório de EPR
Desinfetante, detergente, esponja, etc.	R$ 1.266,96	132.564	1/11/16	Material de limpeza necessário para manter a assepsia no Laboratório
Araldite profissional, conexão femea e PPLF 8 x 1/8	R$ 42,00	7928	14/11/16	Materiais para uso diário no laboratório de EPR
Toner HP CE285 A, Cart. HP21 e 22	R$ 695,00	41.444	17/11/16	Estes cartuchos permitem a impressão em papel dos resultados dos estudos de espectroscopia de Ressonância Paramagnética Eletrônica (RPE) e a impressão dos artigos e relatórios do projeto Centro de Pesquisa, Inovação e Difusão CeRTEV
Bat sel 12V 5A	R$ 1.540,00	22.517	18/11/16	Troca das baterias dos No-Break
Bateria LR-44, bateria CR-2032 e faston Fêmea	R$ 57,99	22.519	19/11/16	Insumos utilizados em multimetros portátil do laboratório
Memória micro SD 64 GB	R$ 94,80	41.520	23/11/16	Cartão de memória para uso do LaMaV
Cabo de impressora USB, T 3 saídas, adaptador p/ tomada universal	R$ 67,80	41.560	25/11/16	Compra de cabo de impressora para ser utilizado com a impressora descrita na nota 41560.
Diesel para gerador	R$ 362,38	36.091	30/11/16	Diesel para abastecimento de gerador de energia
Regulador de posto para nitrogênio	R$ 980,00	12.904	5/12/16	Regulador de gás para ser acoplado a um cilindro de oxigênio do equipamento de análise térmica
Nitrogênio liquido ONU 1977	R$ 220,00	5715	8/12/16	Fluxo de N2 no microforno
Spray cores, veriz, parafuso, etc.	R$ 394,00	5262	13/12/16	Material necessário para construção de cenários teatrais e exposições do Espaço Ventura
Mouse op. C3 Tech s/ fio nano	R$ 42,00	42055	5/1/17	Mouse para computador
HD externo 1TB Seagate USB 3.0	R$ 327,73	42.271	23/1/17	Acessório de informática para arquivamento de trabalhos científicos
Diesel	R$ 360,00	37.632	8/2/17	Diesel para abastecimento de gerador de energia
Argonio 4.8 cil T 10M3	R$ 780,00	299956	14/2/17	Gás utilizado na operação da câmera de atmosfera controlada MBraun, para manuseio de reagentes sensíveis a umidade, tais como carbonatos de Cs e de Mg, utilizados na preparação de vidros fosfatos
Metalon 30x20x1,50	R$ 83,68	18.635	21/2/17	Material necessário para construção de cenários teatrais e exposições do Espaço Ventura
COEL R F FASE BVF1-P 208-480V	R$ 114,41	281.201	21/2/17	Sensor de queda de fase para a proteção do sistema de refrigeração dos eletroimas do laboratório de EPR
Tábua 30x2,5 AP cedrilho 5,00m	R$ 200,00	4.461	22/2/17	Material necessário para construção de cenários teatrais e exposições do Espaço Ventura

Cadinho cerâmico	R$ 1.172,88	18943	28/2/17	Síntese de vidros
Diesel	R$ 360,00	38.438	16/3/17	Diesel para abastecimento de gerador de energia
HD 500GB, placa rede Maxprint	R$ 258,50	43.193	28/3/17	Acessórios de informática para o laboratório
Eletrodo 6013 2,00mm, eletrodo OM inox 308L, etc	R$ 96,42	49.490	4/4/17	Eletrodos de utilização na máquina de solda
Fechadura de sobrepor arouca e chave tipo yale	R$ 112,00	1247	12/4/17	Reparo da fechadura de entrada à sala de laboratório de fornos de preparação de vidros.
Quadro branco mold alum economica 100x120	R$ 149,90	7825	15/4/17	Quadro branco na sala do espectrômetro de alta resolução, para uso em discussões e formação de estudantes trabalhando nos projetos.
Cartuchos HP e toner HP	R$ 511,91	43.584	25/4/17	Cartuchos para impressoras dos 3 laboratorios do Prof. Paulo Pizani
Toner HP CE285 A, Cart. HP F6V28 e F6V29	R$ 464,18	43653	2/5/17	Cartuchos de toner utilizado nas impressoras *Laser Jet* do pesquisador José Pedro Donoso Gonzalez. Estes cartuchos permitem a impressão em papel dos resultados dos estudos de espectroscopia de Ressonância Paramagnética Eletrônica (RPE) e a impressão dos artigos e relatórios do projeto Centro de Pesquisa, Inovação e Difusão CeRTEV
Desinfetante, detergente, esponja, etc.	R$ 752,98	143.360	5/5/17	Insumos para manter a assépsia do laboratório
Bobina pic, açucar cristal, café serra, etc.	R$ 367,08	26.728	11/5/17	Insumos para infra-estrutura do laboratório
MATERIAL PERMANENTE				
DESCRIÇÃO	**VALOR**	**NOTA FISCAL**	**DATA DE EMISSÃO**	**JUSTIFICATIVAS**
Balança analítica cap 320g, kit de medição de densidade	R$ 8.035,50	82.093	25/8/16	Balança analítica Shimadzu AUX-320. Em virtude da colocação em funcionamento da glove-box para preparação de amostras de vidros fosfatos em condições secas (adquirida dentro deste projeto), foi necessário alocar dentro deste equipamento, de forma dedicada, a única balança analítica do laboratório. No entanto, é necessário dispor de uma balança fora da câmera para uso em amostras não sensitivas à atmosfera. Caso contrário, deveríamos usar desnecessariamente a câmera para qualquer tipo de pesagem, o que implicaria no aumento do consumo de gás argônio e na redução da vida útil do circuito de atmosfera regenerativa. Por este motivo, foi adquirida esta alança analítica. - Kit de medida de densidades Shimadzu. Este acessório de precisão amplia as capacidades analíticas de amostras vítreas em nosso laboratório e maximiza o benefício da adquisição da nova balança analítica. Para a antiga balança não existe kit semelhante disponível. A medida de densidades é um experimento simples mas de grande utilidade quando realizado em função da concentração de algum componente do vidro, pois permite detectar alterações no empacotamento molecular através da análise do volume molar. Em combinação com técnicas analíticas mais sofisticadas, como Ressonância Magnética Nuclear e calorimetria de varredura, permite montar modelos da estrutura do material vítreo em escala local e mesoscópica.
Mesa de pesagem anti vibratória c/ tampo de granito	R$ 546,00	82.317	2/9/16	TG-45, MESA DE PESAGEM ANTI VIBRATORIA C/TAMPO DE GRANITO DIM. 40X40X3CM PARA BALANCA ANALITICA
Livro: Electrical Properties of Oxide Materials (Key Engineering Materials) - Ana Candida	R$ 318,70	RECIBO	21/9/16	Aquisição do livro "Electrical Properties of Oxide Materials (Key Engineering Materials)"
Desumificador de ar - Desidrat plus 4 - 127V	R$ 6.320,80	13.902	24/11/16	Controle de umidade da sala do nanodurometro, pois a mesma afeta os valores das propriedades mecânicas do vidro
Oficejet Epson ecotank L375	R$ 1.167,20	41.560	25/11/16	Compra de impressora para uso no laboratório (impressão de artigos científicos, dados da literatura, relatórios, apresentações, etc.)
Forno de 1600°C vertical para viscosímetro e tratamento térmico	R$ 36.564,00	66	23/12/16	Aquisição de forno (sem inclusão das resistências, a serem adquiridas separadamente) para tratamentos térmicos até 1600^{o}C para adaptação de viscosímetro Brookfield e tratamentos térmicos de pequenas amostras, para determinação da viscosidade de vidros experimentais e cinéticas de sinterização e cristalização de vidros em temperaturas superiores a 1000^{o}C obtidas em fornos convencionais.
Servidor/20C/64GB/4TB/120GBSSD	R$ 53.000,00	14	27/1/17	Através do projeto FAPESP 05/01887-2 adquirimos um cluster de 18 maquinas além de um servidor. Parte deste cluster sofreu um up-grade em 2011 com recursos obtidos do projeto CAPES AUX-PE-PNPD 1461/2008. Na época foi necessário refazer o servidore e substituir algumas placas mãe do cluster. Atualmente, vários nós do cluster queimaram, o que tem dificultado a realização satisfatória de nossa pesquisa. No momento tenho um aluno de doutorado, bolsista CAPES, realizando simulações de nanofios de vidros metálicos, uma colaboradora externa, professora do FATEC-Mococa, que vem estudando processos de cristalização em semicondutores, além de um outro professor do DF/UFSCar e eu próprio que estudamos as propriedades estruturais e dinâmicas de vidros de silicatos. Com a deterioração das máquinas antigas, faz-se necessário substituí-las, razão da aquisição desta workstation para que nosso trabalho não seja prejudicado.
Cortador de EPS Profissional - Modelo MP-30 de bancada	R$ 323,50	2604	30/1/17	Cortador de espumas de poliuretano para fabricação de scaffolds vitrocerâmicos
Oficejet HP deskjet 2136	R$ 377,00	43010	15/3/17	Impressora HP *Desk Jet* modelo *Ink Advantage* 2136, para uso do pesquisador José Pedro Donoso Gonzalez no Instituto de Física de São Carlos, USP. Esta impressora permite a impressão em papel dos resultados dos estudos de espectroscopia de Ressonância Paramagnética Eletrônica (RPE) e a impressão dos artigos e relatórios do projeto Centro de Pesquisa, Inovação e Difusão CeRTEV
Agitador Magnético c/ AQ. 220V 50/60HZ - Mod. K40-1820H	R$ 3.591,00	2873	16/3/17	Aquisição de três agitadores magnéticos com aquecimento para preparações de soluções e reações necessárias para a pesquisa em bancada de laboratório.
Monitor Dell 23 polegadas	R$ 612,93	6408624	24/3/17	Parte de um microcomputador completo para o espectrômetro de EPR
Microcomputador Dell XPS 8900	R$ 3.549,11	6411508	27/3/17	Parte de um microcomputador completo para o espectrômetro de EPR
Inversor eletrodo - Merkle Maxxi	R$ 782,94	49.490	4/4/17	Máquina de solda adquirido para confecção de estrtura metálica de forno "otton load" para uso geral do LaMaV
Computador	R$ 5.427,17	43.492	18/4/17	Recurso computacional utilizado para edição de filmes do Porão da Ciência e outros projetos do Ouroboros-CeRTEV
Máquina cortar piso	R$ 933,30	50055	5/5/17	Aquisição de máquina de corte de bancada com disco diamantado para cortes grosseiros de amostras e materiais cerâmicos durante a rotina de operações experimentais de laboratório.
Video GF GTX1050, processador INTEL Core I7, mouse, etc	R$ 4.879,00	27	19/5/17	Computador para o laboratório para analisar dados científicos
Conjunto de periscopio completo e poste	R$ 2.722,00	1610	23/5/17	Sistema telescópico com suporte de espelhos para laser de CO2 para fusão e tratamento térmico superficial em vidros.
Phmetro bancada	R$ 1.600,00	2254	31/5/17	Sistema de medida de pH para verificação da eficiência e calibração de sensores de pH do estado sólido a base de vidros em desenvolvimento no CeRTEV.
DVR 08 canais e disco rígido HD	R$ 1.100,00	1480	1/6/17	Acessório de informática para aparelho de câmera de segurança do LaMaV
Camera AHD 1.3 MP e camera AHD bullet	R$ 800,00	1483	7/6/17	Câmeras de segurança do LaMaV
SERVIÇO DE TERCEIROS				
DESCRIÇÃO	**VALOR**	**NOTA FISCAL**	**DATA DE EMISSÃO**	**JUSTIFICATIVAS**

Serviço audiovisual, locação d eequipamentos, projeção, som e vídeo	R$ 2.260,00	122	2/2/17	Evento denominado como o XXII Simpósio Nacional de Ensino de Física l. SNEF de 23 a 27/01/2017 em São Cartos-SP
Despesas com transporte dos pesquisadores Edgar e Eduardo de S. Carlos a Águas de Lindóia em 16/05/16	R$ 457,65	13.647	23/5/16	Transporte dos pesquisadores Prof. Edgar e Prof. Eduardo para participação do 60º Congresso Brasileiro de Cerâmica em Águas de Lindóia-SP
Correio	R$ 38,00	RECIBO	23/5/16	Envio de biosilicato para Prof. Alcides Gonini Junior da UNOPAR (Maringá - PR)
Despesas com transporte dos pesquisadores Edgar e Luciana de S. Carlos a Guarulhos em 18/05/16	R$ 563,60	13.648	23/5/16	Transporte até o aeroporto de Prof. Edgar Zanotto no período de 18 a 28/05/2016, para participar do "Glass & Optical Materials Division Meeting 2016" apresentando o trabalho intitulado "A random walk through Don Uhlmann's crystallization research" em Madison, WI USA
Correios	R$ 18,70	RECIBO	7/6/16	Envio de documentos para ABC - Associação Brasileira de Cerâmica
Assistência técnica em seu equip FTSSIT	R$ 4.670,00	2538	8/6/16	Reparo e manutenção em perfilômetro alocado no Instituto de Química da UNESP em Araraquara
Despesas com transporte dos pesquisadores Edgar e Luciana de Guarulhos a S. Carlos em 28/05/16	R$ 671,40	13.957	8/6/16	Transporte até o aeroporto de Prof. Edgar Zanotto, retorno do aeroporto de Guarulhosno, para participar do "Glass & Optical Materials Division Meeting 2016" apresentando o trabalho intitulado "A random walk through Don Uhlmann's crystallization research" em Madison, WI USA, período de 18 a 28/05/2016
Manutenção de um ar cond. Split piso teto Carrier 58.000btus	R$ 843,00	2507	22/6/16	Manutenção em aparelho de ar condicionado Split Carrier 58.000BTUS
Correio	R$ 27,90	RECIBO	27/6/16	Envio de formulários de importação para FAPESP
Fotocópias e encadernação em capa dura	R$ 83,40	312	28/6/16	Cópia de material bibliográfico de interesse para a pesquisa, de difícil acesso, para consulta dos membros do grupo
Taxa de inscrição	R$ 250,00	RECIBO	29/06/216	Taxa de inscrição do XXIII Simpep- Simpósio de Engenharia de Produção em Bauru-SP para Prof. Sergio Luis da Silva atuar na Coordenação Científica dp Evento no dia 10/11/16
Impressão de artigo para divulgação cientifica	R$ 300,00	600	30/6/16	Impressão de artigo para divulgação cientifica no Jornal "A Matéria" do DEMa - Departamento de Engenharia de Materiais da UFSCar
Reparo da porta da estufa a vácuo	R$ 1.260,00	79	1/7/16	Reparo da porta da estufa a vácuo
Manutenção de computador	R$ 67,90	539	1/7/16	Manutenção de computador do laboratório
Impressões e encadernações	R$ 1.144,18	2831	8/7/16	Impressão de banners e folders para as apresentações do grupo Ouroboros em atividades realizadas em congressos, eventos dentro e fora da UFSCar
Correio	R$ 20,00	RECIBO	12/7/16	Envio de transformador da fonte de microondas para empresa dar manutenção
Despesa com transporte de alunos do ensino médio para participar da Escola de férias de Engenharia de Materiais	R$ 900,00	61	12/7/16	Transporte de alunos do ensino médio para participar da Escola de Férias de Engenharia de Materiais
fotocópias	R$ 19,20	2330	13/7/16	Fotocopias de documentos
Despesas com transporte dos pesquisadores Eduardo, Edgar, Luciana e Karina de S. Carlos a SP	R$ 645,85	14.477	14/7/16	Transporte dos pesquisadores Prof. Edgar, Prof. Eduardo e Profa. Karina para participarem de reunião na FAPESP realizada no dia 06/07/2016 em São Paulo-SP
Reembolso de submissao do artigo "On the crystallization of gel-derived albite (NaAISi308) - The most stable oxide glass"	R$ 755,12	RECIBO	15/7/16	Serviço de revisão de inglês do artigo "On the crystallization of gel-derived albite (NaAISi308) - The most stable oxide glass" no American Journal Experts
Reembolso de submissão do artigo " Why certain glasses " never" crystallise? A longstanding mystery"	R$ 630,89	RECIBO	15/7/16	Serviço de revisão de inglês do artigo " Why certain glasses " never" crystallise? A longstanding mystery" no American Journal Experts
Reembolso de revisão de inglês do artigo intitulado "ln situ evolution of crystalline phases and elastic properties with temperature in a MgOAI203-Si02- Ti02-Zr02 glass"	R$ 916,53	RECIBO	20/7/16	Serviço de revisão de inglês do artigo intitulado "ln situ evolution of crystalline phases and elastic properties with temperature in a MgOAI203-Si02- Ti02-Zr02 glass" no American Journal Experts
1 painel em lona	R$ 65,00	3278	23/7/16	Impressão de poster para Congresso
Jaleco Brim manga longa	R$ 720,00	343	2/8/16	Confecção de jalecos de laboratório para proteção de membros do grupo de pesquisa ao lidar com produtos e sinteses quimicas
Reembolso revisão de inglês de artigo -Murilo C. Crovace	R$ 918,54	RECIBO	2/8/16	Serviço de revisão de inglês do artigo entitulado "Osteogenic and osteoinductive potentials of a bioactive glass-ceramic (Biosilicate®) with two crystalline phases"
Despesa com transporte do pesquisador EDZ de São Carlos a SP em 25/07/2016	R$ 577,80	14.857	5/8/16	Transporte até o aeroporto de Prof. Edgar Zanotto no período de 25 a 29/07/2016, para participar de reunião técnica na sede da Owens-Illinois (O-I) em Perrysburg, OH - USA
DHL Express envio de carta convite p/Dr. Deubener na Alemanha	R$ 263,00	RECIBO	9/8/16	Serviço de DHL para envio rápido de carta convite para Prof. Deubener pesquisador estrangeiro
Despesa com transporte do pesquisador EDZ de SP a São Carlos em 29/07/2016	R$ 627,85	14.880	9/8/16	Transporte até o aeroporto de Prof. Edgar Zanotto retorno do aeroporto de Guarulhos, no período de 25 a 29/07/2016, para participar de reunião técnica na sede da Owens-Illinois (O-I) em Perrysburg, OH - USA, no período de 25 a 29/07/2016.
Serviço de revisão gramatical, com editoração, de um artigo científico	R$ 1.093,00	519	11/8/16	Serviço de revisão gramatical, com editoração, de um artigo científico com Beatrice Allain
Serviço de revisão gramatical, com editoração, de um Abstract estendido	R$ 317,00	518	11/8/16	Serviço de revisão gramatical, com editoração, de um Abstract estendido com Beatrice Allain
Reembolso submissão do artigo "Bioactive and inert dental glass-ceramics"	R$ 960,97	RECIBO	12/8/16	Serviço de revisão de inglês do artigo "Bioactive and inert dental glass-ceramics" no American Journal Experts
Reembolso submissão do artigo "What is known about the photo-thermal mechanism and crystallization pathways of septuagenarian photo-thermo-refractive glass?"	R$ 1.166,72	RECIBO	12/8/16	Serviço de revisão de inglês do artigo "What is known about the photo-thermal mechanism and crystallization pathways of septuagenarian photo-thermo-refractive glass?" no American Journal Experts
Impressão de poster sulfite	R$ 25,00	2888	17/8/16	Impressão de poster para aluno de iniciação científica Ricardo Lancelotti apresentar trabalho entitulado "Crescimento de Cristais em Metassilicato de Chumbo Vítreo" para participar do Congresso
Conserto de transformador	R$ 85,00	5565	24/8/16	Reparo em transformado da fonte de microondas (Oscar)
Revisão de versão escrita em inglês da Tese de Doutorado de Leonardo Gallo	R$ 1.250,00	1072	24/8/16	Serviço de revisão de inglês em tese de doutorado do aluno Leonardo Gallo
Impressões e encadernações	R$ 192,00	2896	26/8/16	Impressão de tese de doutorado
Inscrição Swarup Kundu - Congresso XV Brazilian MRS Meeting	R$ 850,00	120	29/8/16	Pagamento de taxa de inscrição de Swarup Kundu para pariticipaçaõ do XV Brazilian MRS Meeting
Inscrição SBPMat 2016	R$ 650,00	575	29/8/16	Pagamento de taxa de inscrição para apresentação de trabalho de Prof.Marcello Andreeta para participação do SBPMat 2016
Correio	R$ 67,20	RECIBO	31/8/16	Envio de material impresso para prof. Marcio Nascimento
Correio	R$ 20,00	RECIBO	31/8/16	Envio de documento para empresa Labsynth
Inscrição Raul Julián - XV Brazilian MRS Meeting	R$ 350,00	266	31/8/16	Pagamento de inscrição de Raúl J. R. Tobar no XV Encontro da SBPMat.

Serviço de revisão gramatical de um texto intitulado "GlassPanacea: A USER-FRIENOLY, FREE SOFTWARE TOOL FOR THE FORMULATION OF GLASSES, LASS-CERAMICS ANO CERAMICS"	R$ 235,00	528	13/9/16	Serviço de revisão gramatical em artigo entitulado "GlassPanacea: A USER-FRIENOLY, FREE SOFTWARE TOOL FOR THE FORMULATION OF GLASSES, LASS-CERAMICS ANO CERAMICS".
Inscrição Congresso Salt Lake City	R$ 1.987,99	RECIBO	20/9/16	Pagamento taxa de Inscrição de Prof. Edgar para ministrar invited talk at the MS&T - entitulado "Thirty-year Quest for Structure: Nucleation Relationships in Oxide Glasses" e receber título de FELLOW da AceRS, em Salt Lake City, USA
1 painel gloos paper	R$ 65,00	3484	24/9/16	Impressão de pôster para apresentação de Raúl J. R. Tobar no XV Encontro da SBPMat.
Substituição de dois exaustores das capelas	R$ 890,00	25	26/9/16	Troca de dois exaustores de capela que queimaram (um após o outro). A troca é necessário caso contrário o risco de contaminação devido a falta de exaustão é muito grande.
Importe referente a 09 amostras para análise térmica de Calorimetria Diferencial Exploratória	R$ 720,00	2018	26/9/16	Custos para análise térmica
Análise de sedígrafo - 6pçs	R$ 600,00	203	29/9/16	Análises de matérias primas
02 banners 90x120 lona	R$ 110,00	2999	29/9/16	Impressão de posteres para participação do XV Encontro da SBPMat.
01 banner 90x120 lona	R$ 55,00	2998	29/9/16	Impressão de poster entitulado "Lithium superionic conductor Li1.6Ni1.3(Ti0.6Ge0.4)1.7(PO4)3 : for solid-state batteries" para Swarup Kundu participar do SBPMat - Congresso XV Brazilian MRS Meeting em Campinas
Despesa com transporte do pesquisador Edgar de GRU/São Carlos em 11/09/2016	R$ 712,35	15.732	6/10/16	Transporte de Prof. Edgar Zanotto no dia 11/09/2016, retorno do aeroporto de Guarulhos para participar do "Turner Legacy Symposium" em Sheffield, UK no período de 01 a 11/09/2016
Despesa com transporte do pesquisador Edgar de São Carlos/Campinas em 01/09/2016	R$ 398,65	15.730	6/10/16	Transporte até o aeroporto de Prof. Edgar Zanotto no dia 01/09/2016, para participar do "Turner Legacy Symposium" em Sheffield, UK no período de 01 a 11/09/2016
Correio	32,00	RECIBO	10/10/16	Envio de amostras para Alemanha
Depósito de patentes	R$ 32.684,32	15.782	10/10/16	Despesa de depósito de pedido de patente junto ao INPI intitulado "Processo de recobrimento descontínuo utilizando um biomaterial e bioativo aplicado sobre substratos sólidos, recobrimento descontínuo e seu uso"
Serviço de revisão gramatical, com editoração, de um artigo	R$ 1.259,00	532	17/10/16	Serviço de revisão gramatical de artigo entitulado "A NEW NASICON LITHIUM ION-CONDUCTING GLASS-CERAMIC OF THE Li1+xCrx(GeyTi1-y)2-x(PO4)3 SYSTEM"
Correios	R$ 32,20	Recibo	20/10/16	Envio de amostras para medidas elétricas de sensores de pH a base de vidros silicatos.
Correio	R$ 142,00	RECIBO	20/10/16	Envio de amostras para pesquisa
01 banner 90x120 fotográfico	R$ 50,00	3069	24/10/16	Impressão de poster para participação do CBECIMAT
01 banner 70x110 fotográfico	R$ 50,00	3068	24/10/16	Impressão de poster para participação do MS&T em Salt Lake City, USA
Manutenção em impressora	R$ 80,00	6	25/10/16	Manutenção e reparo em impressora do laboratório
Seguro saúde Salt Lake City e Cusco	R$ 138,98	1324	25/10/16	Seguro saúde para Prof. Edgar para ministrar invited talk at the MS&T - entitulado "Thirty-year Quest for Structure: Nucleation Relationships in Oxide Glasses" e receber título de FELLOW da AceRS, em Salt Lake City, USA e ministrar plenary talk entitulado"Glass-ceramics: A glorious past and bright future" Peruvian Meeting of Materials Science em Cusco, Peru. Período de 21 a 29/10/2016
Manutenção corretiva em dois condicionadores de ar 7.000 btus janela	R$ 420,00	27	26/10/16	Serviço foi solicitado para consertar aparelho de ar condicionado quebrado
Serviço de revisão gramatical, com editoração de um artigo científico	R$ 1.237,00	535	26/10/16	Serviço de revisão gramatical em artigo entitulado
Correção de artigo científico	R$ 180,00	1654	7/11/16	Pagamento de revisão do inglês de artigo científico para publicação no Journal of Non-crystalline Solids.
Serviço de manutenção em Notebook	R$ 150,00	1973	8/11/16	Reparo e manutenção de notebook
Inscrição CBECIMAT - Jairo Felipe Ortiz	R$ 580,00	RECIBO	10/11/16	Pagamento de taxa de inscrição de Jairo Felipe Ortiz para participação do CBECIMAT
Inscrição CBECIMAT - Adriana M. Nieto-Munoz	R$ 580,00	RECIBO	10/11/16	Pagamento de taxa de inscrição de Adriana M. Nieto-Munoz para participação do CBECIMAT
Serviços de soldas em duas bancadas de inox	R$ 520,00	440	10/11/16	Aplicação de solda em bancadas de inox
Serviço de troca de tela, teclado, HD e formatação de um notebook Dell	R$ 1.200,00	34	16/11/16	Atualização de um computador notebook para ser colocado em uso por estudante de mestrado no laboratório.
Serviço prestado no forno 1700*C - Reparo do elevador, aferição e revisão geral	R$ 1.500,00	808	18/11/16	Serviço de reparo do elevador do forno EDG F1700
Serviço prestado no jogo de placa refrataria com resistência	R$ 514,00	807	18/11/16	Limpeza e troca de refratário interno de um forno devido a contaminação com chumbo e corrosão por fluoretos.
Despesa com transporte do pesquisador Edgar de São Carlos a Guarulhos em 21/10/2016	R$ 588,85	16.252	18/11/16	Transporte Prof. Edgar Zanotto até o aeroporto de Guarulhos-SP para ministrar invited talk at the MS&T - entitulado "Thirty-year Quest for Structure: Nucleation Relationships in Oxide Glasses" e receber título de FELLOW da AceRS, em Salt Lake City, USA e ministrar plenary talk entitulado"Glass-ceramics: A glorious past and bright future" Peruvian Meeting of Materials Science em Cusco, Peru. Período de 21 a 29/10/2016
Despesa com transporte do pesquisador Edgar de Guarulhos a São Carlos em 29/10/2017	R$ 677,85	16.253	18/11/16	Transporte Prof. Edgar Zanotto retorno do aeroporto de Guarulhos-SP onde ministrou invited talk at the MS&T - entitulado "Thirty-year Quest for Structure: Nucleation Relationships in Oxide Glasses" e recebeu título de FELLOW da AceRS, em Salt Lake City, USA e ministrar plenary talk entitulado"Glass-ceramics: A glorious past and bright future" Peruvian Meeting of Materials Science em Cusco, Peru. Período de 21 a 29/10/2016
Correios	R$ 41,50	RECIBO	21/11/16	Envio de amostras para pesquisa
Mão de obra para troca de equipamento localizado na sala	R$ 240,00	3417	23/11/16	Mão de obra para troca de equipamento localizado na sala que acondiciona o DSC e o UV-Vis
Conj. Ar Split Springer Midea 18.000 btus frio 220V	R$ 1.988,00	4135	23/11/16	Instalação de ar condicionado na sala que aconsiona o DSC e UV-Vis (pois o antigo não possui concerto) e os equipamentos não podem funcionar em ambiente sem controle de temperatura
1 carga de gás R22 no ar condicionado GREE eletric appliances	R$ 150,00	38	23/11/16	Serviço de carga de gás em aparelho de ar condicionado do LaMaV
Envio de amostras Deubener - 17/11/2016	R$ 240,00	RECIBO	23/11/16	Envio de amostras para Alemanha
Correios	R$ 22,90	Recibo	23/11/16	Envio de amostras para pesquisa
Revisão de inglês de artigo	R$ 1.421,94	RECIBO	28/11/16	Serviço de revisão de inglês em artigo entitulado "The mixed alkali efect on the sinterability and bioactivity of Bioglass 45S5-based compositions. Part I - Replacement of Na2O by K2O"
Serviço prestado no termopar	R$ 284,00	814	28/11/16	Serviço foi solicitado para consertar forno quebrado
1 higienização completa no ar condicionado GREE eletric appliances	R$ 180,00	39	30/11/16	Serviço de higienização completa em aparelho de ar condicionado do LaMaV
Correios	R$ 32,85	RECIBO	1/12/16	Envio de amostras para pesquisa
Reparo computadores, restauração de imagem de instalação em outro disco, etc.	R$ 620,00	368	7/12/16	Troca da placa mãe em notebook que controla a impressora 3D e reestabelecimento do sistema
Despesa com transporte dos pesquisadores José Donoso e Claudio Magon de São Carlos a Guarulhos em 03/12/2016	R$ 628,55	16.560	7/12/16	Pagamento de transporte São Carlos - Aeroporto Guarulhos - São Carlos

Despesa com transporte dos pesquisadores José Donoso e Claudio Magon de Guarulhos a São Carlos em 10/12/2016	R$ 726,30	16.684	16/12/16	Pagamento realizado para financiar as despesas com o transporte dos pesquisadores Prof. Dr. Claudio Magon e Prof. Dr. José Pedro Donoso na visita e pesquisa de campo junto ao Grupo de "Química dos Compostos de Intercalação", Facultad de Ciencias, Universidad de Chile, realizada em dezembro 2016. Informo também que os pesquisadores da Universidade do Chile fazem parte da relação de colaboradores estrangeiros do projeto Centro de Pesquisa, Inovação e Difusão CeRTEV
Cópias A4 sulfite	R$ 123,00	4158	19/12/16	Cópia de material bibliográfico de interesse para a pesquisa, de difícil acesso, para consulta dos membros do grupo.
07 banner 90x120 em lona - banners para divulgação Circo da Ciência	R$ 385,00	3205	20/12/16	Impressão de 7 banners para o Circo da Ciência
Correios	R$ 18,70	Recibo	9/1/17	Envio de amostras para pesquisa
Serviço DHL com destino ao exterior Russia	R$ 329,00	RECIBO	11/1/17	Envio de documentação para obtenção de visto para o Dr. Vladimir Fokin (S.I. Vavilov's State Optical Institute, Russia), para estadia de 1 ano como pesquisador visitante no Departamento de Engenharia de Materiais da EESC/USP, no âmbito do Programa de Professores Visitantes da USP, sob coordenação do Prof. Eduardo Bellini Ferreira.
Despesa com transporte do Sr. Jean L. Souquet de São Carlos a Guarulhos em 19/12/16	R$ 604,40	16.915	16/1/17	Transporte do Prof. Dr. Jean Louis Souquet até o aeroporto de Guarulhos-SP
Serviço de revisão gramatical, com editoração, de um artigo	R$ 882,00	551	17/1/17	Serviço de revisão gramatical, com editoração, do artigo científico intitulado "DISSOCIATION EQUILIBRIUM AND CHARGE CARRIER FORMATION IN AgI-AgPO3 GLASSES".
Serviço de revisão gramatical, com editoração de um artigo científico	R$ 900,00	552	19/1/17	Serviço de revisão gramatical, com editoração do artigo científico intitulado "BIOGLASS® AND RESULTING CRYSTALLINE MATERIALS SYNTHESIZED
Reembolso compra de fusíveis - Maria J. F. Costa	R$ 293,90	RECIBO	26/1/17	Aquisição de fusíveis especiais de ação rápida para reposição dos mesmos, danificados, no controlador do forno de fusão de vidros Deltech DT-31-RS-78.
Manutenção e limpeza de 2 condicionadores de ar Split do lab. RAMAN	R$ 945,00	2744	30/1/17	Conserto aparelho ar condicionado
Correios	R$ 46,80	Recibo	2/2/17	Envio de amostras para pesquisa
Locação de câmeras, gravação e edição de palestras	R$ 1.350,00	614	2/2/17	Evento denominado como o XXII Simpósio Nacional de Ensino de Física l. SNEF de 23 a 27/01/2017 em São Cartos-SP
Locação de bebedouro, climatizador, cadeira, etc.	R$ 1.386,00	222	2/2/17	Evento denominado como o XXII Simpósio Nacional de Ensino de Física l. SNEF de 23 a 27/01/2017 em São Cartos-SP
Reembolso de revisão de inglês de artigo	R$ 1.013,23	RECIBO	3/2/17	Revisão de inglês do artigo intitulado "Bioactive-glass ceramic with two crystalline phases (BioS-2P) for bone tissue engineering"
Submissão de artigos - AJE	R$ 9.280,20	RECIBO	9/2/17	Revisão de inglês nos artigos entitulados: "On the crystallization of gel-derived albite (NaAlSi3O8) – The most stable oxide glass", "Why certain glasses "never" crystallise? A longstanding mystery" , "What is known about the photo-thermal mechanism and crystallization pathways of septuagenarian photo-thermo-refractive glass?", "Bioactive and inert dental glass-ceramics" , "A new highly bioactive crystallization - resistant glass", "A guide walk trough Larry Hench's monumental discoveries", "Isothermal and non-isothermal (kissinger) activation energies for crystal growth in a silicate glass"
Submissão de artigos - AJE	R$ 2.648,08	RECIBO	9/2/17	Revisão de inglês nos artigos entitulados: "In situ evolution of crystalline phases and elastic properties with temperature in a MgO-Al2O3-SiO2-TiO2-ZrO2 glass" ,
Manutenção em 01 amplificador e 01 equalizador	R$ 450,00	14	9/2/17	Manutenção de equipamento para utilização nas atividades de divulgação científica do Ouroboros-CeRTEV
Substituição do motocompressor e limpeza em um ar condicionado Samsung 12.000 btus	R$ 870,00	32	10/2/17	Aparelho usado na climatização da sala do espectrômetro de RMN de alta resolução, onde a temperatura não pode ultrpassar 20oC.
Correios	R$ 170,00	Recibo	3/3/17	Amostras de dissilicato de lítio e metassilicato de lítio, para caracterização das propriedades mecânicas por de resistência á flexão com 4 pontos e resistência á fadiga, enviadas para a Universidade de Trento
Despesa com transporte do Dr. Joachim Deubener	R$ 586,85	17621	6/3/17	Transporte para pesquisador visitante Dr. Joachim Deubener até o areoporto de Guarulhos-SP após 6 meses no LaMaV realizando pesquisa o pesquisador retornou para seu país de origem
Serviços executados em 6 cadeiras giratória e uma poltrona presidente	R$ 660,00	457	10/3/17	Reforma nas cadeiras das salas dos alunos e também do Prof. Nalin cadeira pois estavam muito danificadas devido ao uso frequente.
Reembolso de submissão de artigo	R$ 5.735,48	Recibo	16/3/17	Submissão de artigo entitulado "The microscopic origin of the extreme g/ass-forming ability of A/bite and 8203"
correios	R$ 19,80	Recibo	27/3/17	Envio de amostras para pesquisa
Despesas com Transporte urbano - Yajaira Dalila	R$ 365,26	RECIBO	30/3/17	Transporte da aluna Yajaira Dalila para realizar experimentos junto ao Departamento de Física da Universidade Federal de Goias, Grupo do Prof. Lauro J. Q. Maia
Despesa com transporte do Sr. Edgar São Carlos/Brotas em 20/03/17	R$ 159,90	17.891	31/3/17	Transporte para Prof. Edgar Dutra Zanotto apresentar inivited talk entitulada "Why certain glass forming liquids "never" crystallize?" no NANOMAT 2017 The 7th Latin American Conference on Metastable and Nanostructured Materials, em Brotas-SP, período de 19 a 22/03/2017
Revisão de inglês de artigo - Murilo Camuri Crovace	R$ 950,89	RECIBO	6/4/17	Pagamento de revisão de inglês do artigo intitulado "Osteogenic and osteoinductive potentials of a bioactive glass-ceramic (Biosilicate®) with two crystalline phases"
Submissão de artigo - Edgar	R$ 1.043,31	RECIBO	6/4/17	Submissão de artigo entitulado ""Crystallization pathways and some properties of lithium disilicate oxynitride glasses"
Substituição do compressor 5.5HP trifasico 220V, carga de gás e reoperação do sistema de refrigeração em trocador de calor referente ao magneto	R$ 6.580,00	37	7/4/17	Substituição do compressor do sistema de refrigeração dos eletroimas do laboratório de EPR
Revisão de um artigo em inglês	R$ 425,00	300	7/4/17	Revisão de inglês em artigo entitulado "Elemental and cooperative diffusion in PbSiO3 liquid, supercooled liquid, and glass"
Impressão de Material Bibliográfico	R$ 259,80	403	10/4/17	Cópia de material bibliográfico de interesse para a pesquisa, de difícil acesso, para consulta dos membros do grupo.
Conserto de Nobreak SMS, mod. Power Vision	R$ 210,00	286	17/4/17	Após uma pane elétrica que aconteceu no Instituto de Química e que durou várias horas devido a uma forte chuva, ocorreu a queima da placa do no-break, a qual precisou ser trocada.
Substituição da turbina e carga de gás em um condicionador de ar	R$ 980,00	38	17/4/17	Manutenção de um ar condicionado utilizado no laboratorio para resfriamento de sala onde há equipamentos que necessitam operar em faixa de temperatura controlada.
Manutenção em forno mufla 1300/20 alocado no IFSC	R$ 2.600,00	80	3/5/17	Conserto de forno elétrico utilizado na preparação de amostras
Serviço de instalação de rede de Ar comprimido composta	R$ 4.976,22	69	3/5/17	Pagamento parcial de serviço de instalação de rede de ar comprimido para os laboratórios de materiais cerâmicos e vidros do Departamento de Engenharia de Materiais da EESC/USP, para diversas finalidades, tais como: limpeza de amostras e bancadas; operação de processos de filtragem de laboratório; operação de prensa isostática para confecção de corpos de prova prensados para sinterização; abertura e fechamento de 2 fornos de laboratório para introdução e retirada de amostras durante processos de fusão de vidros, sinterização e tratamentos térmicos de cristalização; operação de equipamento para spray dryer de laboratório em aquisição; etc.

Seguro saúde EUA	R$ 155,00	8135	5/5/17	Pagamento de seguro saúde para Prof. Edgar Dutra Zanotto apresentar invited talk - entitulado "Diffusion processes controlling viscous flow and crystallization in silicate liquids" no 12th Pacific Rim Conference on Ceramic and Glass Technology including Glass & Optical Materials Division Meeting (PacRim12), em Waikoloa, Hawaii, USA
Pedido de patente no exterior composição vítrea, fibras e tecidos vítreos bioativos e artigos	R$ 4.740,00	RECIBO	10/5/17	Pagamento taxa de serviço para pedido de patente no exterior entitulada "COMPOSIÇÃO VÍTREA, FIBRAS E TECIDOS VÍTREOS BIOATIVOS E ARTIGOS"
Pedido de patente no exterior composição vítrea, fibras e tecidos vítreos bioativos e artigos	R$ 871,22	RECIBO	10/5/17	Pagamento taxa de serviço para pedido de patente no exterior entitulada "COMPOSIÇÃO VÍTREA, FIBRAS E TECIDOS VÍTREOS BIOATIVOS E ARTIGOS"
Serviço de revisão gramatical	R$ 1.585,00	572	15/5/17	Pagamento pelo serviço de revisão gramatical, com editoração, de um texto intitulado "A SYSTEMATIC STUDY OF THE THERMAL STABILITY, CRYSTAL STRUCTURE AND ELECTRICAL PROPERTIES OF LITHIUM ION-CONDUCTING GLASS-CERAMICS OF THE Li1+xCrx(GeyTi1-y)2-x(PO4)3 SYSTEM"
Transporte Profº Donoso Guarulhos/São Carlos	R$ 573,80	18679	17/5/17	Pagamento realizado para financiar as despesas com o transporte desde o aeroporto de Guarulhos até a cidade de São Carlos dos pesquisadores Profa. Dra. Andrea Camargo e Prof. Dr. José Pedro Donoso na visita e pesquisa de campo junto ao Grupo de "Química dos Compostos de Intercalação", Facultad de Ciencias, Universidad de Chile, realizada em maio 2017. Informo também que os pesquisadores da Universidade do Chile fazem parte da relação de colaboradores estrangeiros do projeto Centro de Pesquisa, Inovação e Difusão CeRTEV
Transporte Profº Donoso São Carlos/Guarulhos	R$ 626,10	18680	17/5/17	Pagamento realizado para financiar as despesas com o transporte desde a cidade de São Carlos até o aeroporto de Guarulhos dos pesquisadores Profa. Dra. Andrea Camargo e Prof. Dr. José Pedro Donoso na visita de pesquisa de campo junto ao Grupo de "Química dos Compostos de Intercalação", Facultad de Ciencias, Universidad de Chile, realizada em maio 2017. Informo também que os pesquisadores da Universidade do Chile fazem parte da relação de colaboradores estrangeiros do projeto Centro de Pesquisa, Inovação e Difusão CeRTEV
Locação de equipamentos	R$ 3.000,00	250	18/5/17	Locação de equipamento audiovisual para o festival internacional Pint of Science 2017, evento de difusão científica para o público geral utilizando espaços informais. Este evento surgiu na Inglaterra em 2012 e tem sido realizado com sucesso anualmente em 8 outros países.
Inscrição PACRIM 12	R$ 2.782,41	Recibo	29/5/17	Pagamento de taxa de inscrição Prof. Marcelo Nalin para participar do 12th Pacific Rim Conference on Ceramic and Glass Technology (PacRim12), no período de 21 a 26/06/2017 em Waikoloa, Hawaii, USA
Revisão de artigo em inglês	R$ 360,00	346	30/5/17	Revisão de inglês em artigo entitulado Heating rate effects in time-dependent homogeneous nucleation inglasses
Despesas com transporte dos pesquisadores Edgar e Luciana de S. Carlos a Guarulhos em 18/05/17	R$ 639,60	18800	30/5/17	Transporte até o aeroporto de Guarulhos para Prof. Edgar Dutra Zanotto apresentar invited talk - entitulado "Diffusion processes controlling viscous flow and crystallization in silicate liquids" no 12th Pacific Rim Conference on Ceramic and Glass Technology including Glass & Optical Materials Division Meeting (PacRim12), em Waikoloa, Hawaii, USA no período de 18 a 28/05/2017
Despesas com transporte dos pesquisadores Edgar e Luciana de S. Carlos a Guarulhos em 27/05/18	R$ 781,85	18799	30/5/17	Transporte retorno do aeroporto de Guarulhos, para Prof. Edgar Dutra Zanotto apresentar invited talk - entitulado "Diffusion processes controlling viscous flow and crystallization in silicate liquids" no 12th Pacific Rim Conference on Ceramic and Glass Technology including Glass & Optical Materials Division Meeting (PacRim12), em Waikoloa, Hawaii, USA no período de 18 a 28/05/2017
Inscrição Swarup Kundu - XI Brazilian Symposium on Glass and Related Materials	R$ 720,00	Recibo	31/5/17	Pagamento de taxa de inscrição para Swarup Kundu apresentar trabalho entitulado "Electrical properties of Na3.4ScAl(SiO4)0.4(PO4)2.6 glass-ceramics" no XI Brazilian Symposium on Glass and Related Materials no período de 13 a 16/07/2017 em Curitiba-PR
Revisão de inglês	R$ 445,08	Recibo	5/6/17	Pagamento de revisão de inglês no artigo entitulado "Sintering and Crystallization of SrO-CaO-B2O3-SiO2 glass-ceramic with different TiO2 contents"
Serviço DHL com destino ao exterior Itália	R$ 370,00	Recibo	13/6/17	Envio de amostra de vidro Na2O.2CaO.3SiO2 ao Prof. Enrico Bernardo da Universidade de Pádoa (UniPD), Departmento de Engenharia Industrial, para realização de pesquisa em parceria, visando o desenvolvimento de materiais vitrocerâmicos porosos para construção civil e outras aplicações.
Serviço DHL com destino ao exterior Liechtenstein	R$ 370,00	RECIBO	13/6/17	Envio de amostras "glass ceramic" para empresa Ivoclar Vivadent
Primeira parte do abrigo dos Chillcrs c Gases: Nivelamento do terreno; perfuração das cinco estacas de três metros de profundidade; muro de arrimo de cinquenta centirnetrós de altura; confecção de ferragem da viga ba klra me; ccncretagem das brocas e da viga baldrame, impermeabilização do alicerce e assentamento de tijolos tipo baiano até altura de laje. Instalação c concrctagcrn da laje de cobertura.	R$ 10.000,00	8	22/6/17	Primeira parte do abrigo dos Chillcrs c Gases: Nivelamento do terreno; perfuração das cinco estacas de três metros de profundidade; muro de arrimo de cinquenta centirnetrós de altura; confecção de ferragem da viga ba klra me; ccncretagem das brocas e da viga baldrame, impermeabilização do alicerce e assentamento de tijolos tipo baiano até altura de laje. Instalação c concrctagcrn da laje de cobertura. Conforme solicitado em EMU Proc. 2016/04788-0
Inscrição PACRIM 12 - (PARTE DO VALOR EM B.C. E PARTE EM R.T.)	R$ 1.122,97	RECIBO	29/6/17	Pagamento taxa de inscrição para Profa. Ana Candida Martins Rodrigues apresentar um "invited talk" intitulado "Microstructure, compositional effects, and ionic conductivity relationship in highly conductive Nasicon glass-ceramics", no 12th Pacific Rim Conference on Ceramic and Glass Technology (PacRim12), e trabalho oral intitulado "Ionic to electronic conductivity in 0.50[xAg2O(1-x)V2O5]0.50P2O5 glasses" no congresso paralelo, Glass & Optical Materials Division Meeting, ambos realizados em Waikoloa, Hawaii, USA, de 21 a 26 de maio.

DIÁRIAS

DESCRIÇÃO	VALOR	NOTA FISCAL	DATA DE EMISSÃO	JUSTIFICATIVAS
Diárias 18 a 24/07/16 - Viena/Áustria	R$ 7.702,08	RECIBO	1/7/16	Visita cientifica ao laboratorio da Prof. Paola Ayala no Departamento de Fisica da Universidade de Viena, para discussao de possiveis temas de colaboração cientifica, interação/orientação de alunos e apresentação e discussão de resultados.
Diárias 18 a 24/07/16 - Viena/Áustria	R$ 7.702,08	RECIBO	1/7/16	Planejamento das colaborações na Universidade Viena
Diárias 25 a 30/06/16 - Muesnter/Alemanha	R$ 3.209,20	RECIBO	1/7/16	Realização de pesquisa (uso de espectrometro RMN na WWU Münster)
Diária - Franckfurth em 02/05/2016	R$ 874,62	RECIBO	11/7/16	Diárias para Prof. Valmor Roberto Mastelaro visitar a empresa Scienta Omicron para realizar treinamento no equipamento de XPS
Diárias - 28 a 31/08/16	R$ 720,00	RECIBO	29/8/16	Diárias para pesquisador visitante - Augusto Batagin Neto
Diárias 25 a 30/09/16 - São Pedro/SP	R$ 1.800,00	RECIBO	19/9/16	Diárias para participação no XVIII BMIC - Brazilian Meeting on Inorganic Chemistry onde foram apresentados cerca de 10 trabalhos sob minha supervisão.
Diárias Raul Julián - Campinas de 25 a 29/09/2016	R$ 360,00	RECIBO	29/9/16	Diárias para participação do doutorando Raúl J. R. Tobar no XV Encontro da SBPMat.

Diárias Congresso Cusco/Peru - 21 a 29/10/2016	R$ 4.778,70	RECIBO	18/10/16	Diárias para Prof. Edgar para ministrar invited talk at the MS&T - entitulado "Thirty-year Quest for Structure: Nucleation Relationships in Oxide Glasses" e receber título de FELLOW da AceRS, em Salt Lake City, USA e ministrar plenary talk entitulado"Glass-ceramics: A glorious past and bright future" Peruvian Meeting of Materials Science em Cusco, Peru. Período de 21 a 29/10/2016
Diárias CBECIMAT - Adriana M. Nieto-Munoz	R$ 240,00	RECIBO	31/10/16	Diárias para Adriana M. Nieto-Munoz para participação do CBECIMAT no período de 06 a 10/112016
Diárias CBECIMAT - Jairo Felipe Ortiz	R$ 240,00	RECIBO	31/10/16	Diárias para Jairo Felipe Ortiz para participação do CBECIMAT no período de 06 a 10/112016
Diárias 16 a 21/01/17 - Eglantina Espinosa	R$ 1.620,00	Recibo	15/1/17	Pagamento de diárias para financiar a estadia da Profa. Dra. Eglantina Espinoza do Grupo de "Química dos Compostos de Intercalação", Facultad de Ciencias, Universidad de Chile, na visita realizada ao IFSC-USP de 16 a 21 de janeiro, 2017 para fazer pesquisa de campo. Esta pesquisadora faz parte da relação de colaboradores estrangeiros do projeto Centro de Pesquisa, Inovação e Difusão CeRTEV (Fapesp Proc. 2013/07793-6). Esta visita se insere dentro da colaboração científica entre nossos grupos, no qual participam também o Prof. Dr. Claudio J. Magon e a Profa. Andrea S.S. de Camargo, pesquisadores do CeRTEV
Diárias 16 a 21/01/17 - Guillermo Moraga	R$ 1.620,00	Recibo	15/1/17	Diárias para pesquisador Visitante - Guillermo Moraga Gonzalez
Diárias 01 a 07/03/17 - Maceió/AL	R$ 3.180,00	RECIBO	3/3/17	Visita cientifica ao laboratorio do Prof. Carlos Jacinto da Silva no Departamento de Fisica da Univrersidade Federal do Alagoas para discutir trabalho em colaboração, realizar medidas de lente térmica e Z-scan, redigir trabalho conjunto.
Diárias 20/03/2017 - Nanomat 2017 - Brotas/SP	R$ 270,00	RECIBO	23/3/17	Diárias para Prof. Edgar Dutra Zanotto apresentar inivited talk entitulada "Why certain glass forming liquids "never" crystallize?" no NANOMAT 2017 The 7th Latin American Conference on Metastable and Nanostructured Materials, em Brotas-SP, período de 19 a 22/03/2017
Diárias SC/Goiânia/SC - Yajaira Dalila	R$ 1.000,00	RECIBO	30/3/17	Diárias para aluna Yajaira Dalila para realizar experimentos junto ao Departamento de Física da Universidade Federal de Goias, Grupo do Prof. Lauro J. Q. Maia
Diárias Araraquara/Havaí/Araraquara - 20 a 27/05/2017	R$ 311,16	RECIBO	5/4/17	Diárias Prof. Marcelo Nalin para participação do 12th Pacific Rim Conference on Ceramic and Glass Technology (PacRim12), no período de 21 a 26/06/2017 em Waikoloa, Hawaii, USA
Diárias Lavras-MG/São Carlos/Lavras-MG - Dr.Jefferson E. Tsuchida	R$ 1.060,00	Recibo	7/4/17	Diárias para Dr. Jefferson Tsuchida realizar discussões técnicas no LaMaV
Diárias - 17 a 21/04/2017 - Goiânia/São Paulo/Goiânia	R$ 1.440,00	Recibo	18/4/17	Diárias para pesquisador visitante - Ricardo Costa de Santana
Diárias Roger Gomes Fernandes - Uberaba/SC/Uberaba	R$ 1.080,00	RECIBO	20/4/17	Diárias para estadia do Dr. Roger G. Fernandes em São Carlos para realização de discussões científicas, cálculos de cristalização de partículas com o software Mathcad e redação de artigo científico.
Diárias - Sc/Campinas/SC - Benjamin Moulton	R$ 600,00	Recibo	15/5/17	Diarias bolsista 2 FAPESP treinamento LNLS
Diárias - SC/Campinas/SC - David Sampaio	R$ 600,00	Recibo	15/5/17	Diarias bolsista 1 FAPESP treinamento no LNLS
Diárias Hawaii, USA - 18 a 27/05/2017	R$ 3.944,12	Recibo	16/5/17	Diárias para Prof. Edgar Dutra Zanotto apresentar invited talk - entitulado "Diffusion processes controlling viscous flow and crystallization in silicate liquids" no 12th Pacific Rim Conference on Ceramic and Glass Technology including Glass & Optical Materials Division Meeting (PacRim12), em Waikoloa, Hawaii, USA
Diárias - 18 a 28/05/2017 - São Carlos/Havaí/São Carlos	R$ 4.719,24	Recibo	17/5/17	Diárias para Profa. Ana Candida Martins Rodrigues apresentar um "invited talk" intitulado "Microstructure, compositional effects, and ionic conductivity relationship in highly conductive Nasicon glass-ceramics", no 12th Pacific Rim Conference on Ceramic and Glass Technology (PacRim12), e trabalho oral intitulado "Ionic to electronic conductivity in 0.50[xAg2O(1-x)V2O5]0.50P2O5 glasses" no congresso paralelo, Glass & Optical Materials Division Meeting, ambos realizados em Waikoloa, Hawaii, USA, de 21 a 26 de maio.
Diárias 29/05 a 04/06/2017	R$ 1.785,00	RECIBO	5/6/17	Diárias para aluno de Doutorado Paulo Sergio Bayer para realizar experimentos de seu projeto de Doutorado em São Carlos-SP.

TRANSPORTE

DESCRIÇÃO	VALOR	NOTA FISCAL	DATA DE EMISSÃO	JUSTIFICATIVAS
Passagem aérea RP/Curitiba/RP - 13 a 15/07/2017	R$ 656,19	Recibo	7/4/17	Transporte Prof. Marcelo Nalin para participação do XI Brazilian Symposium on Glass and Related Materials no período de 13 a 16/07/2017 em Curitiba-PR
Passagem aérea SP/Honolulu/SP - 18 a 27/05/17	R$ 4.762,73	Recibo	15/2/17	Transporte aéreo para prof. Edgar Dutra Zanotto apresentar invited talk - entitulado "Diffusion processes controlling viscous flow and crystallization in silicate liquids" no 12th Pacific Rim Conference on Ceramic and Glass Technology including Glass & Optical Materials Division Meeting (PacRim12), em Waikoloa, Hawaii, USA
Passagens aéreas - Eglantina Espinosa	R$ 1.027,72	10140	14/12/16	Passagens adquiridas para financiar a viagem da pesquisadora Profa. Dra. Eglantina Benavente do Grupo de "Química dos Compostos de Intercalação", Facultad de Ciencias, Universidad de Chile, realizada de 16 a 21 de janeiro, 2017 para fazer pesquisa de campo. Esta pesquisadores faze parte da relação de colaboradores estrangeiros do projeto Centro de Pesquisa, Inovação e Difusão CeRTEV (Fapesp Proc. 2013/07793-6). Nesta visita do Prof. Gonzalez e da Profa. Benavente discutimos os resultados dos estudos em andamento no IFSC utilizando a técnica de Ressonância Paramagnética Eletrônica.
Passagens aéreas - Guillermo Moraga	R$ 1.027,72	10139	14/12/16	Transporte aéreo para pesquisador Visitante - Guillermo Moraga Gonzalez
Passagens aéreas - Prof. Harold Zarto (pesquisador visitante)	R$ 3.644,29	35593	26/5/17	Passagens adquiridas para financiar a viagem do pesquisador Dr. Harold Lozano do Grupo de "Química dos Compostos de Intercalação", Facultad de Ciencias, Universidad de Chile, em julho 2017 para realizar pesquisa de campo utilizando a técnica de Ressonância Paramagnética Eletrônica no IFSC-USP São Carlos. Estas pesquisas serão realizadas com o Prof. Dr. Claudio Magon e Prof. Dr. José Pedro Donoso pesquisadores do Centro de Pesquisa, Inovação e Difusão CeRTEV
Passagens aéreas RP/SP/Curitiba/Campinas - 13 a 17/07/2017	R$ 499,29	RECIBO	2/5/17	Transporte aéreo para Prof. Edgar Zanotto apresentar trabalho entitulado "Bibliometrics in Glass and other Sciences – Many Shades of Gray!" no XI Brazilian Symposium on Glass and Related Materials no período de 13 a 16/07/2017 em Curitiba-PR
Passagens aéreas Salt Lake - Congresso	R$ 5.515,66	RECIBO	31/10/16	Transporte aéreo de Prof. Edgar Zanotto para ministrar invited talk at the MS&T - entitulado "Thirty-year Quest for Structure: Nucleation Relationships in Oxide Glasses" e receber título de FELLOW da AceRS, em Salt Lake City, USA e ministrar plenary talk entitulado"Glass-ceramics: A glorious past and bright future" Peruvian Meeting of Materials Science em Cusco, Peru. Período de 21 a 29/10/2016