



**MULTIDISCIPLINARY CENTER  
FOR THE  
DEVELOPMENT OF CERAMIC MATERIALS**

PARTIAL REPORT OF THE MCDCM ACTIVITIES COVERING THE BASIC  
RESEARCH, TECHNOLOGICAL RESULTS AND EDUCATIONAL ACTIVITIES

PERIOD FROM JANUARY 2008 TO DECEMBER 2008

February 2009

**Overview**

This report encompasses all the main activities developed in the center during the last year, emphasizing that in 2008 the activities of the center were as intense as in former year for all levels, including the scientific production, innovation activities as well as the continuous education and dissemination of scientific knowledge to the society. However, the focus of this report is to demonstrate that innovation character has become very important. The productivity of the majority of the groups has been improved year by year, demonstrating that the synergy of the groups by means of collaborations continues to be a key factor. It is also important to remark that the collaboration with international groups has also increased, including the participation of the members in international scientific activities such as participation as authors in books and reviews devoted to traditional and modern fields of research.

The total amount of publications involving members of the center is about 169 papers being 153 in international periodicals, about 8 in national periodicals and 4 book chapters. The quality and quantity can be considered very good; in addition, we are involved in a strong effort to modify the research structure in order to yield different type of device-based systems. At the several research areas of the Research Division, the number of papers per area was as follows: Chemical Synthesis = 35; Semiconductors and Ferroelectric Materials = 33; Optical and Electrochromic Materials = 23; Crystal Growth and Non-Crystalline Materials = 34; and Design, Fabrication and Characterization of Microdevices Based on Magnetic and Superconducting Thin Films = 36. Figure 1 shows the relative productivity by research lines.

This high productivity of the center has been recognized by the international scientific community, since several leader members of the center have been invited to organize meetings or to give seminars and to write invited papers in international meetings related with ceramic materials. One paper was invited as a review in the area of nanostructured materials for electrochemical energy production and storage. In addition, 6 invited papers were given by members of the centers in international meetings. It is important to remember that two researchers of the center are members of the International Academy of Ceramics.

The results in the Innovation Division of the Center are growing with other outside companies which are joined with the center by means of collaborative technological research projects. One important factor is the satisfactions of the companies with the results of these projects. This can be evidenced by the fact that the great majority of the companies renew these projects with the center year by year. These achievements are related to the high motivation as well as the excellent management. Projects have been contracted by large companies like CSN (more than 17 years) and IIPF-EMS (3 years), as well as by medium and small companies (KosmoScience, Nanox, Unilever, Angelus, Sencer, Togni, to name just a few. In this year, 4 patents have been deposited. Other signature of the excellence of the work developed with industries, besides the technical solution for the companies and the number of papers published with members of the companies (5). It should be also stressed that many projects with industries are well related with research line of members of the center. Many projects are based on Tin Oxide ceramic, which has been studied extensively by the members of Center. In this sense, the degree of innovation is quite high. Our studies in synthesis and doping of tin oxide also originate a project for production of semiconductor enamel for electrical porcelain. This project started last year with exciting results for commercial applications. The continuous education and dissemination division of the center has increased and a plethora of activities will be carried out following a well-established program for the next years. In this sense, our program in this third year encompassed the diffusion through the lectures in elementary and high schools about several subjects related to the chemistry and physics of ceramic materials as well as the Ceramic Materials Educational Project, as described in the second report. Moreover, in this year was offered by the center a course on nanotechnology for undergraduate students from several universities. Many diversified activities like hosting teachers and high school students, basic courses for craftsman located in several places, production of educational video, linking PhD students to industrial sector, to name just a few.

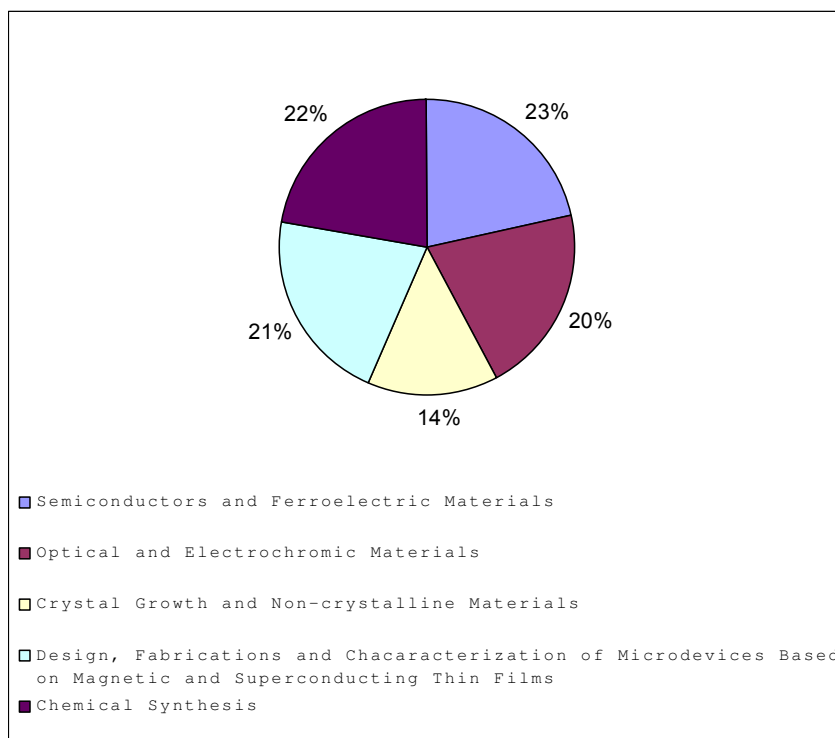


Figure 1 - Innovation Activities developed in our Center.

### Basic Research - 2008

As observed in the last years, the total number of published papers is quite expressive. Besides, the quality of the publication is high, since we are capable to publish in high impact magazines. In this report, we will give a brief description of the basic research activities developed in the last year (2008). More details about a specific project or a specific development can be obtained in the published paper. This brief description will be divided in topics related to researches areas.

#### a) Crystal Growth and Non-Crystalline Solids

The main results were related to the growing of single crystal fibers for optical and dielectric studies, vitreous thin films of YAB composition and glass-ceramic for dosimetric devices. An abstract of these more important results about crystal growth and non-crystalline solids are below presented. Microwave dielectric properties and photoluminescence of undoped and europium oxide doped  $Ta_2O_5$  fibers, grown by laser heated pedestal growth technique, were determined. The effects of  $Eu_2O_3$  doping (1-3 mol %) on the structural, optical, and dielectric properties were investigated. At a frequency of 5 GHz, the undoped material exhibits a dielectric permittivity of 21 and for  $Eu_2O_3$  doped  $Ta_2O_5$  samples it increases, reaching up to 36 for the highest doping concentration. Nevertheless, the dielectric losses maintain a very low value. For this wide band gap oxide,  $Eu^{3+}$  optical activation was achieved and the emission is observed up to room temperature. Thus, the transparency and high permittivity make this material promising for electronic devices and microwave applications. Vitreous thin films of  $Y_{0.9}Er_{0.1}Al_3(BO_3)_4$  (YAB) were studied. Precursor solutions were obtained using a modified polymeric precursor method using D-sorbitol as complexant agent. The chemical reactions were described.  $Y_{0.9}Er_{0.1}Al_3(BO_3)_4$  composition presents good thermal stability with regard to crystallization. The  $Y_{0.9}Er_{0.1}Al_3(BO_3)_4$  crystallized

phase can be obtained at 1,150°C, in agreement with other authors. Crack- and porosity-free films were obtained with very small grain size and low RMS roughness. The films thickness revealed to be linearly dependent on precursor solution viscosity, being the value of 25 mPa s useful to prepare high-quality amorphous multi-layers onto silica substrates by spin coating with a gyrset technology. The thermoluminescence (TL) response of Dy and Li doped  $20\text{CaB}_4\text{O}_7\text{-}80\text{CaB}_2\text{O}_4$  (wt%) glass-ceramic irradiated with ultraviolet (UV) radiation was studied. In order to act as TL activator ions, the Dy and Li ions were included in the matrix during the melting process to increase its TL efficiency. A single crystalline  $\text{CaB}_2\text{O}_4$  phase was present in the glass-ceramic as determined by X-ray diffraction (XRD). The glass-ceramic  $20\text{CaB}_4\text{O}_7\text{-}80\text{CaB}_2\text{O}_4$  : Dy,Li wt% (named 20CB07:Dy,Li) is a newly prepared TL material. Its thermoluminescent dosimetric characteristics have shown a linear response under UV radiation exposure and a good TL signal reproducibility, thus proving to be a promising material for using as an ultraviolet radiation dosimeter.

#### **b) Electronic ceramics**

Many studies in bulk or thin films have been performed during this period aiming to better understanding their ferroelectric and dielectric properties for applications like DRAM and FeRAM memories. These studies include several perovskites structures such as PZT, BIT, SBT and others. In particular we have performed studies in Bismuth Ferrites with both, ferroelectric and magnetic properties. Thin films with this composition modified with rare earth showed excellent ferroelectric properties. The non-ohmic and dielectric properties of the intriguing CCTO system have been analyzed in our group. Very important results have been observed in this system, including a giant dielectric constant and non-ohmic (varistor type) behavior. Relative dielectric constant as high as 500,000 has been measured under special conditions as well as high non-ohmic behavior ( $\alpha > 50$ ). It was found that the non-linear coefficient reaches values of 65 for microwave-sintered samples and 42 for samples sintered in a conventional furnace when a current density interval of 1-10 mA  $\text{cm}^{-2}$  is considered. The non-linear coefficient value of 65 is equivalent to 1500 for samples sintered in the microwave if a current interval of 5-30 mA is considered as is shortly discussed by Chung et al (2004 Nature Mater. 3 774). Due to a high non-linear coefficient and a low leakage current (90  $\mu\text{A}$ ) under both processing conditions, these samples are promising for varistor applications. Study in this system is underway in order to understand the intrinsic or extrinsic nature of this huge dielectric constant.

Intense and broad photoluminescence (PL) emission at room temperature has been observed on structurally disordered perovskite powders synthesized by the polymeric precursor method. Zirconates, Titanates, Molibidates, Tungstates powders were annealed at 573 K for different times and at 973 K in oxygen atmosphere and showed intense photoluminescence at room temperature. Moreover, the emission of wide band photoluminescence showed a synergic effect on barium zirconate and barium titanate thin films in alternate multilayer system at room temperature by 488 nm exciting wavelength. Quantum mechanics calculations were used in order to simulate ordered and disordered powders or thin films structures. The disordered models, which were built by using the displacement of former and modifier networks, showed a different symmetry in each system, which is in accordance with experimental photoluminescence emission, thus allowing to establish a correlation among the structural and optical properties of these multilayered systems. Structural defects of disordered powders or thin films, in terms of band

diagram, density of states, and electronic charges, were interpreted using high-level quantum mechanical calculations at the density functional framework.

### c) Chemical Synthesis

In this field, the main research focus was the development of a new synthetic route for ceramic nanocrystal, performed in organic solvents. This route was used to synthesized  $ZrO_2$ , Sn- $In_2O_3$  (ITO),  $SnO_2$  and  $Sb-SnO_2$ (ATO) nanocrystals, with good shape and size control. For instance, it was obtained  $ZrO_2$  nanocrystal with spherical like morphology and size in the range of 4 nm and a narrow particle size distribution, as illustrated in the Figure 1.

Other important topic that we devoted special attention was the study of nanocrystal growth mechanism during the synthesis process. We demonstrated that the use of microwave heating during hydrothermal treatment drastically decrease the treatment time required to obtain gadolinium-doped ceria nanorods, and that the oriented attachment (OA) is the dominant mechanism responsible for anisotropic growth. In fact, considering the OA as a statistical mechanism, we are postulating that the growth process conducted under microwave heating increases the effective collision rate. A plausible explanation for the increase of the effective collision rate under microwave irradiation is the increase in the collision cross-section of the particle.

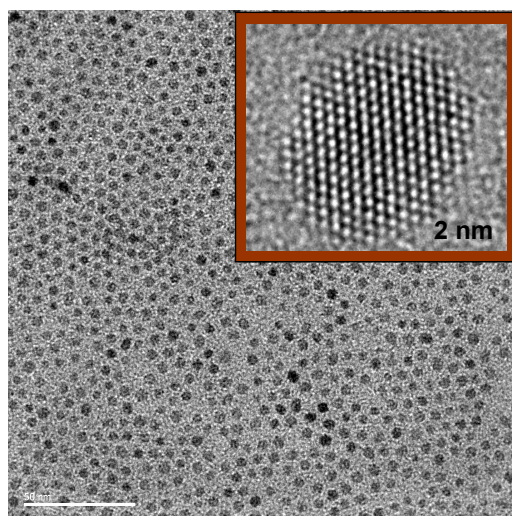


Figure 1 - HRTEM image of  $ZrO_2$  nanocrystal processed by solvothermal process. The inset shows in detail the nanocrystal synthesized in our center.

## 2 - Innovations Activities

In terms of technological innovations, the Center developed several projects in collaboration with the industrial segment. These projects resulted in several patents and papers. The interaction with industries was conducted through specific projects with the different members of the Center. In general way, the projects developed with different companies can be classified in the following groups: Technological support, "Spin-off Companies", News products (PIPE projects) and Basic Research. The Figure 2 illustrated the projects classified in the different groups.

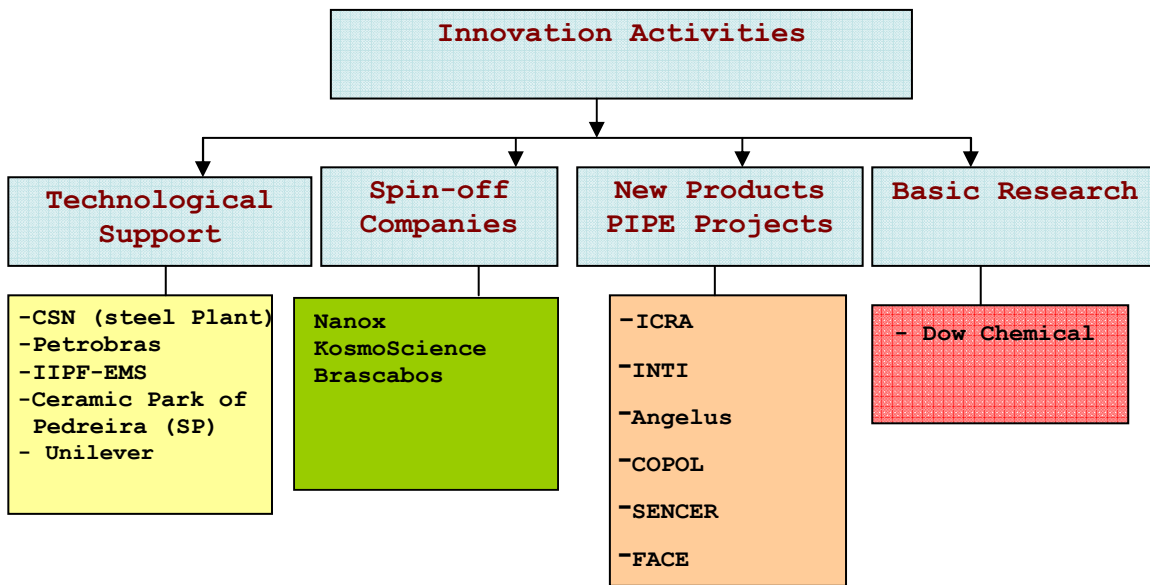


Figure 2 - Innovation Activities developed in our Center.

### 2.1 - Technological Support

The projects developed in the metallurgical sector with the CSN company, comprise advanced refractories that have to be applied in order to assure high metal quality from both economical and ecological aspects. During services, refractories must not only tolerate high temperature but also withstand stress (thermal and / or mechanical) as well resistance to combined attack by liquids such as molten metals, slags and fluxes.

The project contracted by the Petrobras (Brazilian Petroleum Company) is the development a new catalyst material based on  $Al_2O_3$ - $ZrO_2$  system. Basically, the project consist in modify the  $Al_2O_3$  surface using a nanolayer of zirconia and analyze the influence of the  $ZrO_2$  layer in hydrogenation reactions.

### 2.2 - "Spin-off Companies"

In the past 4 years, ours students nucleated two small companies, based on research develop in our Center. The first one was the Cosmo Science and the main purpose of this company is to develop analytical procedures to characterize cosmetics products, as well as, the interaction of the cosmetic with hair and skin. The interaction between our Center and the Kosmo Science is to provide the facilities (spectroscopy and microscopy instruments).

The second company nucleated in our Center was the Nanox. The goal of this company is to develop nanostructured coating with functional properties such as: anti-bactericide and hard coatings.

### 2.3 - News products (PIPE projects)

In this area, the main idea is the development of new products in collaboration with small companies and with the financial support of the FAPESP, through PIPE projects. An example of project is the development of translucent alumina pieces for dentistry applications. This project was contracted by Tecnident Ltda., of the dentistry sector aiming to produce translucent alumina brackets.

Other example of project is the development of a 100% ceramics dental restoration, aiming to replace the traditional metal/ceramic dental restoration. This project is very complex, because demand the development of a porous ceramic matrix and the development of a glass that will be infiltrated in the porous matrix. After the glass infiltration, a composite material is formed with excellent mechanical properties. Shows an example of a ceramic dental restoration develop with the EDG Company. Nowadays, this project is in a second phase of the PIPE project supported by the FAPESP.

### 2.4 - Basic Research

This new group of projects started in last year and the main target is to obtain financial support for basic research from private companies. The first project was contracted with the Dow Chemical and is related to the development of nanocomposite materials, as decribed in the last year.

In 2008, we obtained a new contract from PETROBRAS S.A., in order to develop basic research related to the use of ceramics nanobelts and nanorods, mainly SnO<sub>2</sub> and SnO, for gas sensor. The basic idea is to use this nanostructured material to detect very low concentration of gases (ppb) such as H<sub>2</sub>S and CH<sub>4</sub>. Figure 4 describe some nanostructure architectures that will be studied.

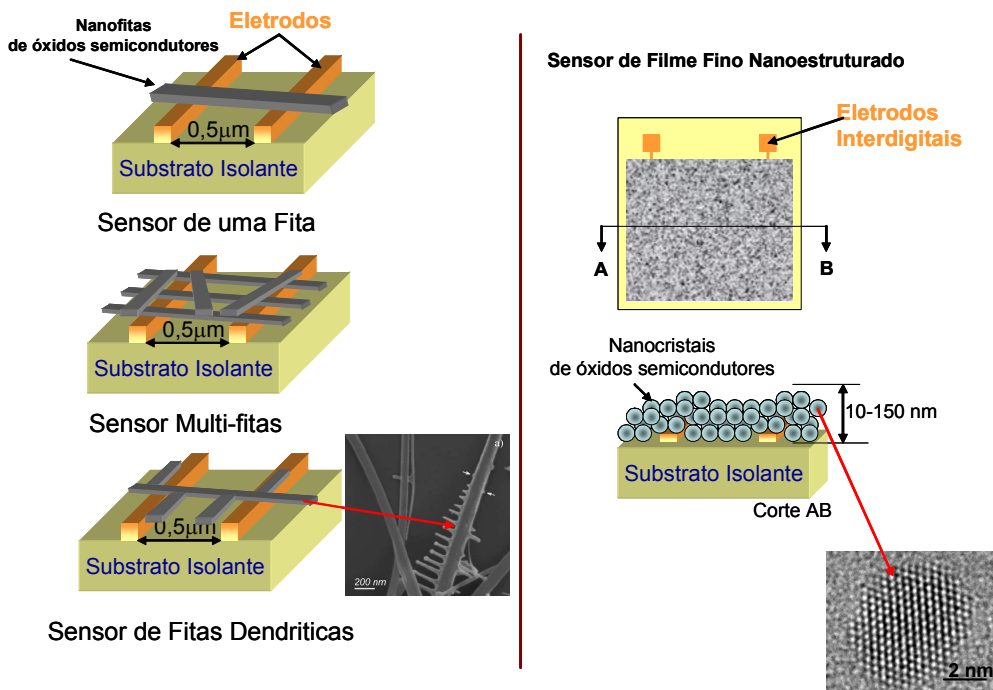


Figure 4 - New gas sensors devices in developments.

### 2.5 - Polycrystalline Semiconductors

Concerning polycrystalline devices it was done an invited review that describes mainly the history of SnO<sub>2</sub>-based voltage-dependent resistors, which was developed by the MCDM. This review was published in the Journal of European Ceramic Society. It was discusses the main characteristics of these polycrystalline semiconductor systems and includes a direct comparison with traditional ZnO-based voltage-dependent resistor systems to establish the differences and similarities, giving details of the basic physical principles involved with the non-Ohmic

properties in both polycrystalline systems. As an overview, the text also undertakes the main difficulties involved in processing SnO<sub>2</sub>- and ZnO-based non-Ohmic systems, with an evaluation of the contribution of the dopants to the electronic properties and to the microstructure and consequently to the system's non-Ohmic behavior. However, since there are at least two review texts regarding ZnO-based systems, the main focus of the present text is dedicated to the SnO<sub>2</sub>-based varistor systems, although the basic physical principles described in the text are universally useful in the context of dense polycrystalline devices. The text describes specifically how the microstructure heterogeneity and grain boundary chemistry are capable to interfere in the global electrical response for particular systems. New perspectives for applications, commercialization and degradation studies involving SnO<sub>2</sub>-based polycrystalline non-Ohmic systems are also outlined, including recent technological developments. Finally, at the end of this review a brief section is particularly dedicated to the presentation and discussions about others emerging non-Ohmic polycrystalline ceramic devices (particularly based on perovskite ceramics) which must be deeply studied in the years to come, specially because some of these systems present combined high dielectric and non-Ohmic properties. From both scientific and technological point of view these perovskite systems are quite interesting.

## **2.6 - Nanomaterials and Nanostructures for Alternative Energy Devices**

An in-depth understanding of the processes involved in the operation of electrochemical cells is crucial in the development of new methods for the design of more efficient electrochemical cells destined specifically for energy conversion and storage. An indispensable aspect of this body of knowledge is a thorough grasp of the synthesis and design of functional electrodes and electrolytes with unusual and valuable properties which, today, are provided to a large extent by the nanosize effect of these cells' functional components. Indeed, future developments in this field will necessarily depend on nanoscience and nanotechnology as has been done by the MCDCM.

The main focus of this area of research, therefore, is to develop novel strategies that exploit nanoscale architectures to enhance the efficiency of alternative energy conversion and storage devices and on the basic principles of electrochemistry governing the effects of nanoscale on electrodes and electrolytes. In addition, the MCDCM introduces basic principles of nanotechnology to guide the reader through this incipient interdisciplinary boundary. The scope of ensembles of nanosized objects and products that have been and can be created is truly remarkable. Moreover, the potential impact of these products on basic science and applications is so great that the subject is inexhaustible, particularly in view of the enormous diversity of nanosized objects. Therefore, this area of research must perforce be limited to objects and systems that already show real promise for a variety of applications.

The electrochemical manufacture of small objects ranks high in the design of new materials and systems with special properties. However, although the mechanism of formation or removal of small individual portions of solids plays a decisive role in the field of electrochemical nanotechnology, the use of electrochemistry as a tool for the preparation of nanostructures for electrode and electronic applications lies outside the scope of this chapter. In other words, the absence of this and other related topics clearly indicates, from the start, that no attempt will be made to cover the field comprehensively here.

## **2.7- Development of automotive temperature sensors.**

Metalurgica Iguaçú Ltda. Different kinds of perovskite-based NTC temperature sensors have been synthesized by mixing, pressing and sintering Ni, Cu, Mn, and Co oxides. Some compositions have also been synthesized by a modified polymeric precursor technique. The electrical characterization was carried out by dc methods. An experimental sequence for producing large quantities of each composition was evaluated for the scaling up of the thermistor production. The challenge posed by local industries looking for Brazilian-made temperature sensors for application in the automotive industry has been overcome: four out of six thermistors with behavior similar to commercial thermistors have been successfully developed.

## **2.8- Development of translucent alumina pieces for dentistry applications.**

This project was contracted by Tecnident Ltda., of the dentistry sector aiming to produce translucent alumina brackets.

## **2.9 - Development of nanoparticulated ceramic pigments for masterbatches production.**

This project was contracted by COPOL - Compostos Poliméricos industry, São Carlos, SP. The first step of the Project has been concluded.

## **2.10 - Development of a nanocomposite for fire retardant.**

This project was contracted by Brascabos, Rio Claro, SP. This project is under progress.

## **2.11 - Presently the artistic and china ware ceramics are the most competitive in the international market.**

In order to improve the regional competitive conditions, it was signed an extended contract project with 29 industries of the Ceramic Park of Pedreira (SP). The project focused two main line actions: 1) development of batch formulation; 2) establishment of a conceptual base as the design trade mark for the ceramic ware produced in Pedreira. The new batch formulation, using a new set of raw materials, allowed a cost reduction with raw materials as well as an improvement of the properties of the final products. It can be emphasized the reduction of water absorption from 32% to 11% in the ceramic ware. The design project consisted in modifying the geometry of ceramic articles, the design of ceramic products as well as to propose the idea of that the segmentation of the product lines in small industries bring advantages in terms of production and commercialization of the ceramic ware.

## **3 - CONTINUOUS EDUCATION AND DISSEMINATION DIVISION:**

A total of **31,112 students** participated of our activities in 2008. To get an idea of increasing the number of students who participated in our activities in education and scientific dissemination, in the year 2005 were 2,245 students; in 2006 were 6,233, and 2007 were 13,183. Over the past four years grew more thirteen times the number of students participating in activities related to science and technology.

*Another highlight of 2008 was the release of videos **Nanoart 1** and **Nanoart 2** created by researchers of the MCDCM. Nanoart is art and nanotechnology intersections. Nanosculptures and nanolandscapes are visualized with powerful research tools like scanning electron microscopes with field emission gun. The monochromatic scans are captured in a computer, painted and manipulated digitally. The video was composed of the final artworks more classical music.*

The activities in this year can be summarized as:

#### I - MCDCM in the School

Our activities of teaching and dissemination of knowledge related to the Ceramics Center in the School were:

##### 1.1. Short-courses about materials science: Glass materials

In this school-year (2008) we decided to focus on the theme vitreous materials for students 15 years-old to evaluate the use of conceptual maps in the teaching-learning process. The choice of theme glasses was due to abundance of glassy materials in the home environment of students. The results obtained in the evaluation of conceptual maps revealed that the students do not have an organized knowledge about the features more intrinsic of vitreous material, despite the clear knowledge of their importance in our day to day.

School name and city	Students	Day/month
Escola Estadual Prof. Sebastião de Oliveira Rocha	27	13/may
Escola Estadual Prof. Sebastião de Oliveira Rocha	10	21/may
Escola Estadual Prof. Sebastião de Oliveira Rocha	25	27/may

##### 1.2. Seminars about education and dissemination of science:

Three of the five seminars about our capacity to undertake the dissemination of materials science involving the subject in 2008 occurred abroad, as listed below:

Title	Public/ Institution	Participants	Day/Month
O uso dos mapas conceituais aos alunos de escolas públicas.	Alunos da Licenciatura em Ciências Exatas /USP- São Carlos	40	25/06
Análisis de los mapas conceptuales elaborados por estudiantes de la octava serie de la enseñanza fundamental a partir de lecciones pautadas en la teoría del Aprendizaje Significativo: la arcilla como tema de estudio.	Estudantes e professores/ <b>Universidade de la Republica/ Montevideo-Uruguay</b>	30	23/07
Universidade pública: uma realidade para todos	Alunos premiados da IV OMQF, familiares e professores/ <b>UFSCar</b>	450	13/09
Um estudo de atividades pautadas na teoria da Aprendizagem Significativa e desenvolvidas com alunos de escolas públicas: a argila como tema	Estudantes e professores/ <b>Universidade de Aveiro/ Portugal</b>	20	30/10
Atividades de Difusão Científica do Grupo de Crescimento de Cristais e Materiais Cerâmicos	Professores e alunos/ <b>Universidade de Aveiro/ Portugal</b>	20	03/11

## II - The School in the MCDCM

### 2.1 Teaching Science through experiments:

Activities	School name and city	Day/Month	Students present
Lectures and physics experiments demonstration at Institute of Physics of S. Carlos, USP	-E.E. José Ferreira da Silva, Descalvado (SP)	20/06	45
	-E.E. José Ferreira da Silva, Descalvado (SP)	22/08	42
	- Escola Dom Bosco/ Monte Aprazível (SP)	05/09	40
	- E.E. Profa. Carmela Morano Previdelli, Taquaritinga (SP)	10/09	40
	- E.E. Cooperativa Educacional de Barra Bonita (SP)	24/09	45
	- Universidade Estadual Paulista (UNESP)/ Rio Claro (SP)	28/09	25

### 2.2 Competition on fundamental science (MPCO):

Activities	Day/Month	Students present
4 <sup>nd</sup> Mathematics, Physics and Chemistry Olympiad (MPCO)	16/06	29.803
MPCO awarding-day	13/09	450

#### One Day of Undergraduate Student

Researchers of MCDMC have participated of the open school day in Diocesano School (São Carlos) presenting the comic book to stimulate the students discussing about clay, mineral exploration and electronic ceramics.

#### III - NANOART VIDEOS

Two videos showing nanostructures and nanolandscapes were produced and made available on the Internet (sites: youtube and cmdmc), and recorded on DVDs for distribution in schools, educational institutions and others.

The video **Nanoarte 1 Da colméia às Flores** can be seen:

<http://www.youtube.com/watch?v=BbulzOL46ro>

The video **Nanoarte 2 Dance of Nature** can be seen:

<http://www.youtube.com/watch?v=hYJX8qN8dWY>

#### Production of DVD

In this period, ten production of DVD were produced (films during 15 minutes). They were exhibited in high schools and during lectures in the country and abroad. The main objective of the DVD is to show in a clear and scientific way the development of the research activities of the Center, mainly in Nanostructured Ceramics and Nanoparticles, Ceramic Interfaces, Varistors, and Sensors. Nowadays, this way of diffusion has already guaranteed a space in the national media in paid TV channels.

#### DVD 11

Programa 41: "Retenção de bactérias - Óxido de cobre como fungicida - Dica de ciência - Nanomateriais"

Programa 42: "Dispositivos eletroquímicos- Dica de ciência-Fotoluminescência"

Programa 43: "Nanotecnologia no Brasil- Dica de ciência- Nanocatalisadores"

Programa 44: "Nanocatalisadores- Encapsulamento de nanopartículas (2)- Dica de ciência- Nanotubos"

#### DVD 12

Programa 45: "Síntese de nanopartículas (2)- Óxido de titânio bactericida- Dica de ciência-Fotoluminescência"

Programa 46: "Nano na Odontologia- Modificação de superfícies sólidas- Dica de ciência- Fixação de cor"

Programa 47: "Projeto Pedreira/ Inovação Tecnológica- Catalisador óxido de cério- Dica de ciência-Nanopigmentos para cabelos"

Programa 48: "NANOX- Prêmio Finep (Sudeste)- NANOX- Dica de ciência- Jogos educativos na WEB"

#### Diffusion in Newspapers, Radio and TV

It is important to point out the interface of MCDCM with the media. In this period, information about Ceramic Materials was disseminated by means of written press, radio and TV. Newspapers from São Carlos (Primeira Página, A Folha and Araraquara (Imparcial) have covered news about MCDCM achievements in the Innovation Projects, emphasizing the development of materials made in partnership with CSN, NANOX, Angelus LLPI Ltda, IIPF-EMS and KosmoScience. O Diário Oficial (Imprensa Oficial), and O Estado de São Paulo (a newspaper of national coverage) also reported the achievements of MCDCM emphasizing the advantages that the industrial partners of MCDCM have had with such a fruitful partnership, Magazine: Pesquisa/FAPESP.

The technical developments obtained in Materials Science (photoluminescence, nanoparticles, and nanostructure) has benefited the whole region, showing clearly the multiplying role of the University-Industry interaction. As a consequence, EPTV, the main TV company of the Central Region produced a serie of reports covering the activities of MCDCM and TV Globo and Record (TVs of national coverage).