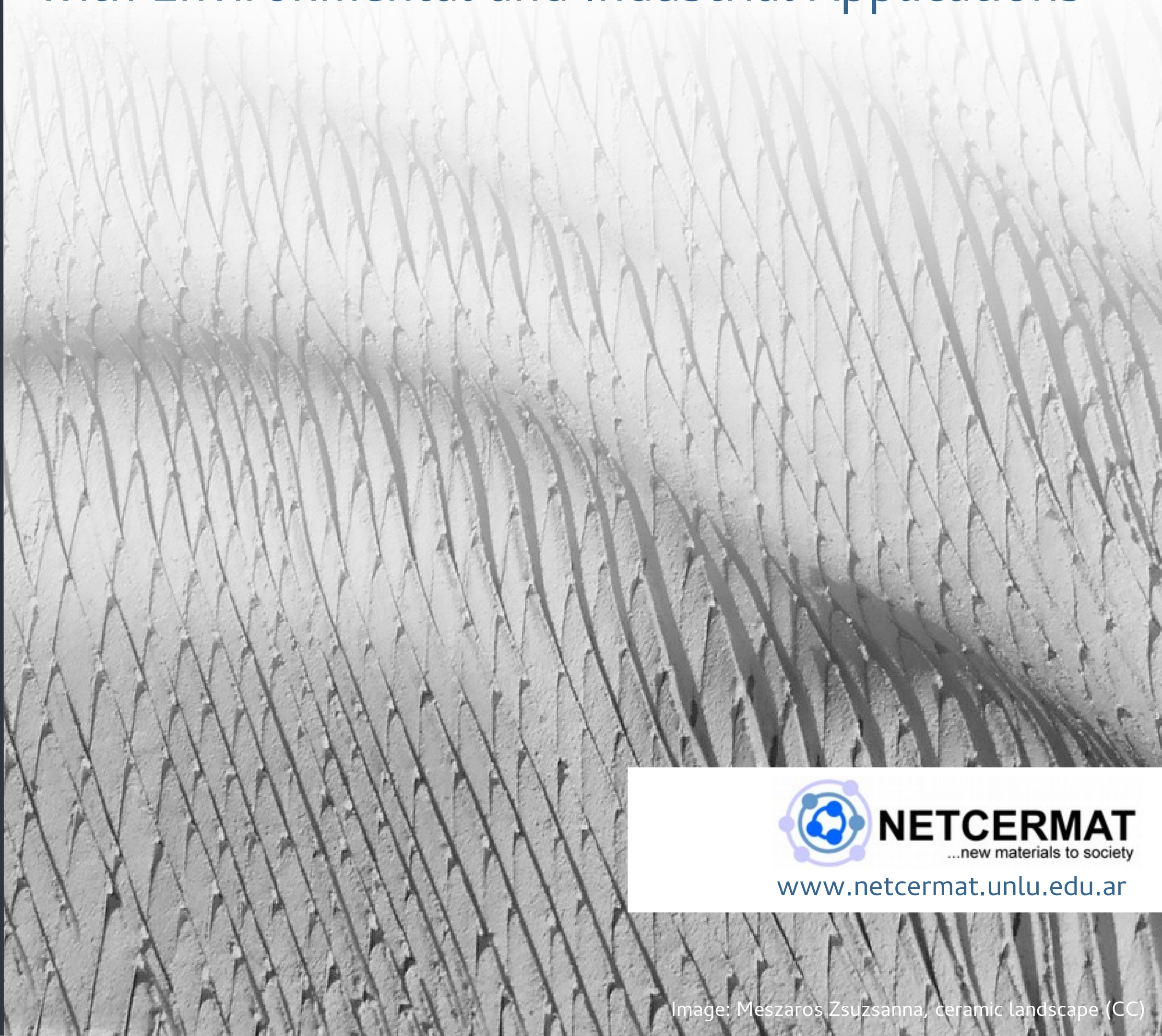
1 newsletter 2014

NETCERMAT

...new materials to society

EULA NETWORK IN CERAMIC MATERIALS

with Environmental and Industrial Applications



NETCERMAT

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Image: Meszaros Zsuzsanna, ceramic landscape (CC)

EUROPEAN COMMISSION

PEOPLE

MARIE CURIE ACTIONS

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EULA NETWORK IN CERAMIC MATERIALS
with Environmental and Industrial Applications

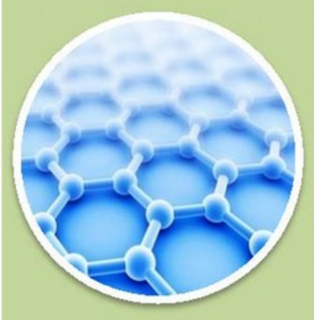
Information technology and electronic industries are emerging as the two bastions of advanced ceramics' market since late '90s. Rising demand for high-performance electronic, computing and communication devices is propping the large-scale adoption of advanced ceramic compositions within these industries. Cross-application synergies are also upstaging, unveiling newer and more sophisticated application platforms for advanced ceramics. Thus, with the revenue charts increasingly tipping towards the high-end markets, the industry's end user profile is undergoing rapid transformation, away from the conventional end-use markets such as defense equipment, chemical processing, and glass industries. Other sector of capital importance is focused in Environment, because some of the advanced ceramics play an important role in the remediation or control of polluted waters, soils or waste. Environment is a key sector in the collaboration between the EU and Latin-America

Commercial use of advanced ceramics is limited by the complexity and high costs of implementation; skepticism about the long-term stability and consistency of material properties, coupled with lack of industry-wide standardization, high cost of components and absence of performance tracking deterring the full-scale commercialization of advanced ceramics until recently. However, burgeoning research and developments and new product innovations are expected to drive new opportunities for advanced ceramics in the coming years. Additionally, growing impetus for environmental protection is likely to bolster demand for the use of the materials in replacement applications that are touted as environmentally unsafe. Of late, rising shipments of commercial aircrafts and future orders, particularly from the US and Asian countries, is expected to assure a stable market for advanced ceramic coatings in the next five years (2011 -2015)

EULA–NETCERMAT will be focused on advanced/modern ceramic materials (MAC) applied in high added value industrial sectors for both EU27 and LA countries with existing S&T cooperation agreement such as Argentina, Brazil and Chile. The specific scientific and technological issues where Marie Curie Fellowships will be focused on 3 main areas such as Science and Technology of Advanced ceramics, Socioeconomic studies and Impact on civil society, through different issues listed below.

Advanced Ceramic Materials synthesis and characterization

- Homogeneous composition and controlled crystal sized
- Arrangement, integration and dispersion control
- Regular pore structures
- High order structural control from micrometer to nanometer order
- Characterization by X-Ray and Neutron Diffraction



Advanced Ceramic Materials Applications

- Bio-inspired nanolayered cercamics
- Ultrafine-grained transparent cercamics
- Nitride particles- Sialon phosphors LEDS)
- Porous cercamics

Advanced Ceramic Materials socioeconomic aspects and impacts

- State of the arts and needs, EU-LA
- Academia, industry, civil society

Dissemination

- Action Plan
- Business plan
- Workshops
- Seminars
- Open day sessions

Fig 1. Focus of EULA-NETCERMAT proposal

Objective and relevance of the Joint Exchange Programme

Modern Advanced Ceramics (MACs) are characterized by their high strength, texture, longevity, chemical inertness and electrical resistance. Their most distinguishing feature is that they are "more resistant to heat than any other material on the face of the earth" (Peterson, 2003). According to Cérame-Unie (2007), the world ceramics market is worth in the EU region 25% of €120 billion.

MACs market has experienced growth in both areas of the application of new and traditional. In traditional applications, the growth came from improved performance, either by a complementary role or the substitution of conventional materials, new applications, MACs assume greater role to provide certain services not possible before. Technological innovations over the years have contributed to improvements in performance and productivity, to popularize an important factor for the use of advanced ceramics in several sectors. MACs find diverse applications in modern industry such as health and medicine, environment and energy, transport and space and communication and information, promising to transform the entire industrial scene.1 A roadmap for advanced ceramics2 for the period from 2010 to 2025 has been developed to provide guidelines for future investments for policy makers, scientists and industry alike. Only in the EU the materials market (including MACs) is stimated in 125 billions EUR.

From a R&D and Academia point of view, in recent years, the developments of new devices supporting advanced industries such semi-conductor /IT Industries, environmental industries, nuclear power, aerospace, medical devices, and many others, and development of equipment, higher efficiency, and reduction of environmental loads have been strongly required. For this reason, during these last years, the industrial world, and civil society is pushing the public authorities to develop projects and create new research centers in the area of the materials required to make progress possible. Among the traditional materials, ceramics have played since its inception a key role in social and technical development. Today is the edge of Nano-ceramics, which will improve substantially the properties of traditional ceramics, from their temperature resistance, optical properties, electrical, magnetic etc., thus it will be possible to create the so-called Innovative multi-functional ceramics.

To observe the overall framework in which are inscribed these efforts, and in the specific field of innovative ceramics or nano-ceramics, we might look at the comments that have appeared recently on December 2, 2010 in the journal Nature (Vol 468, p. 627) on an article in preparation of P. Shapira and Jue Wang. These authors attempt to trace the money invested in nanotechnology research related to scientific articles published. Obviously, these data refer to all the Nanotechnology and not just Nano-ceramics, but despite this, give us a clear idea of the overall situation. Using a broad–based definition of Nanotechnology, the authors identified more than 91.500 articles published worldwide between August 2008 and July 2009 (four times more publications than in 1998). Figure 2, illustrates the inexistence of statistically significant collaborations between European countries and Mexico, Brazil and Argentina, which represents a vital collaboration field which will play a crucial role in the future technological development of each region and each country. To enable collaboration on specific areas, one of the best ways is undoubtedly the exchange of students and teachers in a fully open collaborative framework. Therefore, EULA-NETCERMAT will focus on partnerships in the area of advanced ceramics based on nanotechnologies due to its future a crucial importance.

Such figures and the request from the industry, reveal a promising future nanotechnology and nano-ceramics. However there is a need for an enhancement of fundamental research in critical identified areas such as nanomaterials synthesis, nanomaterials analysis, and nanomaterials modeling to overcome major challenges and barriers recognized. Otherwise, the development of new nano-materials and nano-ceramics will still be limited by our knowledge rather than by our resources. Such barriers and challenges involve:

- Achieve a much better control of the size and shape of the primary materials to exploit their full potential
- Develop a new level of analytical capability for characterization of nano-materials, nano-ceramics, and nano-devices under relevant operating conditions as well as with the highest resolution and sensitivity
- Develop a detailed microscopic understanding of how a given artificial nano-architecture and its properties are related (structure- properties relationships).

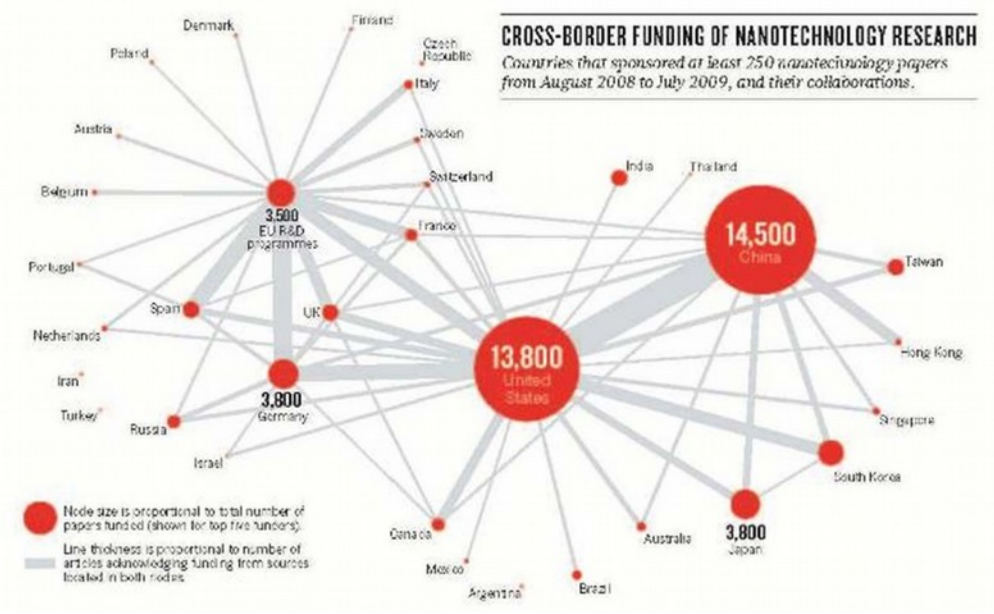


Fig.2 Cross-Border Funding of Nanotechnology Research

The design of MACs requires new concepts, which will inter alia be based on interdisciplinary strategies. The expert input from the field of physics, chemistry, engineering and biology is required. This poses a challenge both for future research structures, as well as for the future training of young scientists who not only have to remain experts in their own field, but must also improve their literacy in neighboring fields. Also is mandatory that the experts in materials and ceramics synthesis collaborate intimately with the experts in Materials structural Characterization (X-Ray Crystallography, Electron Microscopy, etc.), and experts in materials functions and with materials modeling

From a Society and Industrial point of view, given the strong long-term opportunities in this industry, should the producers of the current weak demand focus resources and investment in research and development, process optimization oriented view ceramic production, processing means for technological superiority and quality control equipment and customized marketing strategies. As an example, the different applications of ceramics and in particular micro and nanoceramics, depend on the production of defect-free single and mixed phase ceramics with 50 nm grain size. This imposes requirements on improved process control in order to achieve reproducible and reliable behavior during the application either of existing or upcoming materials in particular those with a specific nanostructural design.

Analyzing the industrial sector, MACs sub-sector is very diverse but manufacture is usually carried out in kilns in the same way that other ceramics are produced. They are based partly on clays and on synthetic raw materials and they are used, inter alia, in electronics products, biomedical innovations and automobiles. Many technical ceramics are innovative and of relatively high value and low weight, reducing energy intensity and giving greater scope for exports.The three phases of the research in this field are: Fundamentals, Synthesis and Processing, and Applications. In each of these three areas the most interesting points and the most common characterization techniques are highlighted, as well as a separation is done between the microstructure ceramics and nanoceramics.

OBJECTIVES: To solve some of the exposed challenges and barriers exposed on the relevance of the thematic, the main ojectives proposed for the exchange programe within EULA-NETCERMAT involve:

- Enhance human capacity of LA partners by the exchange of know-how and experience, with the support of the EU research centers, organization of twining activities, workshops, training courses etc.
- Supporting innovation and fostering cooperation with industry (EU and LA). Action and Business
- Plans for the industry, mainly the ceramic industry in Argentina, Brazil and Chile.
- Achieving and reinforce present and future ERA through close cooperation with LA partners.
- Improvement the existing technical and scientific and management capacities of EULA-NETCERMAT partners. (FP8 particiaption of Latin American partners).
- Dissemination and diffusion of results of EULA-NETCERMAT between all relevant and indentified stakeholders according with the Triple Helix (academia, industry and political authorities)

In order to complete these objectives series of activities will be undertaken such as:

1. Mobilities: A total of 206 exchanges (263/m) are planned (66 exchanges/year). 26 % (1st year), 31 % (2nd year), 23 % (3rd year), 20 %(4th year). The greatest part of the exchanged corresponds to researchers (seniors or young), the rest to technics-administrative.
2. Education and Training: by educational modules on MACs topics capable to generate economic activities with attendant socio-economic impacts on local populations. After completing the modules a platform for on-line courses at the involved LA universities will be created (UNLu responsibility).
3. Action and Business plan: such documents derived from the EULA-NETCERMAT SWOT analysis, will identify and prioritize which systems and processes must be sustained and provide the necessary information for maintaining the activities in order to reach future objectives (scientific-technological and also in economic terms).
4. Dissemination of results: through the specifically designed tools (see WP 5).

The successful completion of the EULA-NETCERMAT project will result in three major outputs:

5. Highest quality competence in research in advanced ceramics with significant influence on the socio-economic development of the region/country
6. Reinforce ERA as an internationally-renown partners of LA and initiator of cooperation projects in the next FP8 with SICA dimension and development of the close cooperation with outstanding EU and LA partners
7. Synergy of the research offer with the requirements of innovation market and industry well developed cooperation Academia-Industry (LA and EU) and high number of technical applications due to the future of ceramic materials.

COORDINATOR TEAM

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Nelcy Della Santina Mohallem

MOBILITIES EU»LA LA»EU

INTEMA

Pablo Botta	October – December 2013 (ICMAB/UAB)
Miriam Castro	2015
Alejandra Fanovich	September – November 2013 (ICMAB)
Rodrigo Parra	July – September 2014 (KTH)
Sergio Pellice	July – September 2014 (KTH)
Raúl Procaccini	September – December 2013 (KTH)

IRELAC

Christiane Daem	Oct 2012 – February 2013 (IRELAC-LATAM)
Florencia Crocci	March – April 2013 (UNLU-IRELAC)
Thomas Zadrozny	November 2013 (IRELAC-LATAM)

ICMAB

Elies Molins	October 2012 (ICMAB-CSIC → UCH)
Sergio Pellice	February 2013 (INTEMA → ICMAB-CSIC)
Guillermo González	February 2013 (UCH → ICMAB-CSIC)
Susana Garelik	July 2013 (ICMAB-CSIC → INTEMA)
Alejandra Fanovich	Sep – October 2013 (INTEMA→ ICMAB-CSIC)
Elies Molins	October 2013 (ICMAB-CSIC → UCH)

Related to Kick-off Meeting attendance – February 2013

Alicia Gallo	(UNLU → ICMAB-CSIC)
Florencia Crocci	(UNLU → ICMAB-CSIC)
Ruben Reinoso	(ADRAM → ICMAB-CSIC)
Nelcy Della Santina	(UFMG → ICMAB-CSIC)
Karina Ferreira	(SENAI → ICMAB-CSIC)

Gustavo Pérez (UAB) at the Kick-off Meeting in Brussels, 2013

Alicia Gallo's (UNLU) speech in Rosario, Argentina, 2014


UAB and Brazilian Team with ITAGRES people, Brazil

QIES Presentation in Almería, Spain, 2014

Completed work

DIFFUSION ACTIVITIES AND PRESENTATIONS

- **Kick-off Meeting**
  March 1st, 2013
  Institut Catholique des Hautes Etudes Commerciales (ICHEC)
  Boulevard Brand Whitlock, 2
  1150 Bruxelles (Métro Montgomery)
  Université libre de Bruxelles (BRUSSELS)

- **International Seminar: "La nanotecnología: Eje importante para el futuro de la cooperación CELAC-UE"**
  February 28th, 2013
  Université libre de Bruxelles (BRUSSELS)

- **2do Encuentro Provincial de Nanotecnología para la Industria y la Sociedad**
  April 18th, 2013
  Rosario, ARGENTINA
  "La Nanotecnología en Alimentos", Dra. Alicia Gallo (UNLU)

- **La nanotecnología: Eje importante para el futuro de la cooperación CELAC-UE**
  ITAGRES Presentation
  Tubarão - SC, BRAZIL

- **First Year Meeting**
  November 4-6, 2013
  Criciuma, BRAZIL

- **EULA NETCERMAT presentation on Reunión del Grupo de Química Inorgánica y del Estado Sólido (QIES)**
  June 16th, 2014
  Almeria, SPAIN

- **Course X-Ray Diffraction by Prof. Lluis Casas**
  July 2014
  Universidad de Chile

UPCOMING ACTIVITIES

- **Second Year Meeting**

- **Secondment of Rosaura Piccoli**
  (ADRAM) to UAB-ICMAB, October 2014

- **Secondment of Elies Molins**
  (ICMAB-CSIC) to UCH, November 2014