



European Commission



European Materials Forum

Lisbon 2007 Declaration

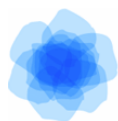
On

**International Cooperation in  
Materials Research:  
Key to Meeting Energy  
Needs and Addressing Climate  
Change**

Conclusions of the  
First World Materials Summit

Held under the auspices of:  
Portuguese European Presidency

Lisbon  
5<sup>th</sup> October 2007



PORTUGAL 2007

Presidência Portuguesa da União Europeia 2007 - Evento de interesse científico - Ciência 2007UE

# Materials Scientists Unite to Battle Climate Change

## “LISBON 2007”

Top materials scientists from around the world met under the auspices of the Portuguese European Presidency in Lisbon on October 4<sup>th</sup>/5<sup>th</sup> to tackle the problem of climate change. Selected delegates from all around the world discussed how best to reduce CO<sub>2</sub> emissions during energy production and use, by means of new and innovative materials and processes. Industry, university, and government representatives examined possible strategies for low emissions energy technologies including solar energy, wind power, biofuels, hydrogen fuel cells, and nuclear fission and fusion. Each of these technologies requires new and improved materials to increase efficiency and reliability, decrease greenhouse gas emissions, reduce capital costs, and extend operating lifetimes. The meeting concluded that the present pace of research and development was too slow to meet the needs of world's rapidly growing and increasingly energy-hungry population. Effort was too fragmented, and competition between different laboratories and institutions hindered progress on complex problems where international cooperation was vital to achieve breakthroughs. In a final plenary session, the scientists present unanimously agreed to set up a new global networking initiative to coordinate and accelerate efforts in this area. **The global network, CORME\* (Coordination of Research on Materials for Energy) will be organized by the International Union of Materials Research Societies (IUMRS), working in conjunction with regional and national Materials Research Societies and related bodies. For Europe, the European Materials Forum (EMF) regrouping most of the materials actors will be in charge. It will have these key objectives:**

- (1) Produce internationally agreed strategic plans (“road maps”) for the development of new and improved materials for future energy technologies.
- (2) Bring together leading academic, public sector and industrial scientists in a series of focused workshop meetings, to discuss important technical issues, to ensure that key problems are tackled in a swift and effective manner. Several topics have already been selected and the agenda be prepared:
  - Transformation and recycling of CO<sub>2</sub> into a new raw material,
  - Hydrogen generation and storage,
  - Clean Coal,
  - Nuclear energy: Fusion and Fission, in particular for hydrogen production
  - Fuel Cells Technologies (Sydney 2008)
- (3) Identify and train a new generation of young international leaders for energy research and development.

\* *corne* is a tube-like structure which occurs in certain plants and stores fuel and energy. Grow it, and it produces a beautiful flower – e.g .a crocus or gladiolus

- (4) Promote major new international collaborative research programmes in energy materials.
- (5) Provide information to global, regional and national policy makers, and to investment analysts in the energy sector.
- (6) Ensure that manufacturers in the energy sector, especially SME's, have the best possible access to information on innovative materials developments.
- (7) Interface with other key international organizations in the energy sector.
- (8) Stimulate public interest in, and awareness of, energy-related issues.

The First World Materials Summit Meeting was held at Hotel Corinthia in Lisbon, Portugal, on 4<sup>th</sup> – 5<sup>th</sup> October 2007, on the theme "Materials Research: Key to Meeting Energy Needs and Climate Change". The scientific programme was organized by the European Materials Forum (EMF).

**CONTRIBUTORS:**

- Presidência Portuguesa da União Europeia 2007
- International Union of Materials Research Societies (IUMRS):
  - A-MRS (Materials Research Society of Australia)
  - B-MRS (Brazil Materials Research Society)
  - C-MRS (Chinese Materials Research Society)
  - E-MRS (European Materials Research Society)
  - MRS (Materials Research Society, USA)
  - MRS-T (Materials Research Society of Taiwan)
- Federation of European Materials Societies (FEMS):
  - DGM
  - Sociedade Portuguesa de Materiais (SPM)
- European Science Foundation (ESF)
- ALSTOM
- European Technology Platform on Advanced Engineering Materials and Technologies (EuMaT)

**EMF:**

The European Materials Forum "EMF" is a non profit organization integrating the major materials related scientific organizations in Europe, as well as certain industries. The founding members include:

- All European Academies (ALLEA)
- European Academy of Sciences and Arts (EASA)
- European Federation of Scientific and Technical Networks of Cooperation (FER)
- European Materials Research Society (E-MRS)
- European Neutron Scattering Association (ENSA)
- European Physical Society (EPS)
- European Science Foundation (ESF)
- European Science-Industry Consortium for Biomaterials & Health Care (EUROBIOMATEX)
- European Science and Technology Universities
- Euroscience
- Federation of European Materials Societies (FEMS)
- Freiburger Materialforschungszentrum (FMF)
- French Aeronautics and Space Research Center (ONERA)

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EMF

BP. 20 – 67037 Strasbourg cedex 2 – France  
Tel: +33 (0)3 88 10 65 43 / Fax: +33 (0)3 88 10 63 43  
[emrs@emrs.c-strasbourg.fr](mailto:emrs@emrs.c-strasbourg.fr)

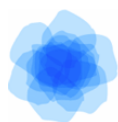


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## APPENDIXES



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# Appendix 1

## INTRODUCTION

- ◇ The scientific evidence is now overwhelming: climate change is a serious global threat, and it demands an urgent global response. (Intergovernmental Panel on Climate Change (IPCC) / UNEP<sup>1</sup>-WMO<sup>2</sup>)
- ◇ Climate change will affect the basic elements of life for people around the world: access to water, food production, health and the environment. Hundreds of millions of people could suffer hunger; water shortages or coastal and inland flooding, as the world warms. (N. Stern<sup>3</sup>: Report to British Government)
- ◇ Every country will be affected, starting with the poorest
- ◇ A range of options exists to cut emissions, but strong and decisive policy actions are required to motivate their take-up.
- ◇ Climate change demands an international response, based on a shared understanding of long term goals and agreement on the frameworks for action.

Among the key elements of future international frameworks is the need for strong technology cooperation, as well as formal agreements to boost the effectiveness of investments in research and innovation.

<sup>1</sup>: UNEP: United Nations Environmental Programme

<sup>2</sup>: WMO: World Meteorological Organisation

<sup>3</sup>: N. Stern: former chief economist World Bank

## **THE IMPORTANCE OF MATERIALS**

Advanced materials, materials research and innovation are probably the most important elements to develop the required new technologies needed to provide a clean reliable energy supply with a significant reduction of CO<sub>2</sub> emissions. New concepts as well as closer collaboration between fundamental research and industry are necessary, but also, much closer collaboration between all the countries of world is essential.

## **THE MATERIALS SCIENTIFIC COMMUNITY**

The scientific materials community in Research, Development and Technology is well organized, both at the European as well as at the wider International level:

- ◇ The EUROPEAN MATERIALS FORUM (EMF) brings together over 120 national and European scientific societies active in the field of advanced materials. The EuMaT Technology Platform has assembled over 700 members from both industry and academia and several other European Technological Platforms consider more specific questions.
  
- ◇ At the world level the INTERNATIONAL UNION OF MATERIALS RESEARCH SOCIETIES (IUMRS) has been created on the basis of the multidisciplinary model created in the USA by the Materials Research Society (MRS), the effectiveness of which has led to the creation of similar structures all over the world: from North and South America to Europe, Russia , P.R. China, Taiwan, India, Japan and Australia.

# Appendix 2

## GENERAL CONSIDERATIONS

1. Current projections estimate that the energy needs of the world will more than double by the year 2050. This will be coupled with increasing demands for clean energy. These demands cannot be met by existing technologies.
2. Advanced materials technologies have already demonstrated (e.g. GaN lighting) a significant contribution to make to the reduction of CO<sub>2</sub>.
3. Key objectives that have been proposed :
  - a. A target of 20-20-20, which translates to that by the year 2020, we should have saved 20% of the total primary energy consumption and achieved 20% of the overall energy mix from renewable energy sources by the Intergovernmental Panel on Climate Change (IPCC).
  - b. A "reduction by a factor of 2 in the annual emissions of greenhouse effect gases by 2050 by the Nairobi Climate Conference in November 2006<sup>1</sup>
4. Considering the urgency of the energy problem, the magnitude of the needed scientific breakthroughs to achieve the above targets, and the current rate of scientific discovery, current efforts will likely be too little, too late. A disruptive fundamental materials research effort is needed immediately, since at least twenty years are necessary to transform a discovery in an industrial product
5. A new and sustained international interdisciplinary materials research collaboration is, therefore, essential to provide the breakthroughs required looking for synergy and "critical mass notion"

<sup>1</sup>: Developed countries should have a factor of 3-4 reduction to allow the developing ones to progress faster.

# Appendix 3

## OUR CONSIDERATIONS

In order to affirm this strategy the committee of the World Materials Summit Lisbon October 2007 has collected some of the manifold proposals to realize in best way the acceleration of development within the worldwide materials science and technology community:

**1. Present technologies do not allow going out of fossil fuels**

At an all the time growing need for energy supplies it is evident that for the future the presently used technologies we can impossibly go out of fossil fuels. However, when continuing to use fossil fuel resources we have to do it in a much more efficient and responsible way<sup>1</sup>.

The best way to get out of the conflict is the fast development of new technologies, thus the development and application of more efficient energy-using materials in all sectors, i.e. buildings, transport, equipment and industry. The World Summit 2007 proposes to establish a **Materials Research and Technology Milestone Agenda** for a coordinated roadmap for international collaboration in fundamental research, especially oriented to transport.

**2. Advanced materials can contribute to the reduction of CO<sub>2</sub> emissions**

To promote expansion of the economy without harming the environment, technology that can raise the efficiency of energy consumption must be developed, we must develop new concepts, raise the efficiency of goods-distribution, reduce the amount of pollutants expelled into the environment, and monitor the causes of environmental destruction. In all these processes materials play a fundamental role. Therefore the World Summit 2007 proposes to extract from the numerous propositions formulated around the world the essential directions to be developed together. The expected innovations coming out of the fundamental programs can generate a strong economical development in fully new domains.

<sup>1</sup>: Fossil fuels are still largely available, however, they are also the basis of organic chemistry, a much "nobler" application

**3. Fundamental research is needed for innovative new technologies** – urgent paradigm shift for development

Generally basic research contributes to solve also technological most complex issues. However in order to get to innovative novel technologies a paradigm-shift is necessary.

The World Summit 2007 proposes that in the field of fundamental research offensives goals of new development (e.g. such as the desire to lower material costs for fuel cells by 90%) shall be collected and within the mass of applications for funding proposed as “projects of urgency to save the planet” that shall be proposed to politicians, industry deciders and research communities to be adequately financed. Recycling CO<sub>2</sub> into a C-H compound would completely modify the present day situation. However, the technologies are not yet available and they will need fundamental breakthroughs to become effective.

**4. The present technologies cannot generate hydrogen without CO<sub>2</sub> emission**

The Hydrogen Society regarding peoples mobility is one of the focus item of the World summit. Enormous progress has been made in fuel cells, especially operating with H<sub>2</sub>. Cars and buses are already available for demonstration of the concepts all around the world. Secure storage and cost have still not been solved in a satisfactory way and new concepts and materials are drastically necessary to promote this technology. The acceptable cost of fuel cells is far to be reached and the production and storage in a clean and safe manner are also largely open questions.

**5. Only solar, nuclear and bio-energy are eligible for low CO<sub>2</sub> emission:** Need for a reflected medium term agenda

This shows that the worldwide shift towards non-emitting CO<sub>2</sub>-energy production is inevitable and must be done immediately. Therefore, only solar energy as well as a further controlled use of nuclear energy is a vital solution, at long term bio may also be an alternative. A combination of nuclear and solar equipments may be an efficient source to produce CO<sub>2</sub> free hydrogen or electricity.

**6. The cutting objectives by 2020 – political commands and highly focused development**

When the current international commitments are renewed in 2012, the EU will push for developed countries collectively to reduce their emissions of greenhouse gases by an amount in the order of 20% by 2020 compared to 1990. Irrespective of what other countries do, the EU has made a firm independent commitment to achieve a reduction of at least 20% by 2020.

The actual goal, often phrased by 20:20:20 is

1. saving 20% of energy consumption compared to projections for 2020;

2. increasing to 20% by 2020 the share of renewable energies in overall energy consumption;
3. cutting greenhouse gas emissions by at least 20% by 2020

In addition to that the EU proclaims by 2020 the increasing to at least 10% the share of biofuels in overall petrol and diesel consumption, a better integration of EU energy markets, a better integration of EU energy policy with other policies, such as agriculture and trade and finally more international cooperation: if the EU can take a common approach on energy, and articulate it with a common voice, it can lead global debate.

In order to achieve these goals, the Global Materials Research Community can contribute enormous impetus by developing novel materials. This summit proposes a close worldwide cooperation in which the development of novel materials within all related consortia must be established in order to accelerate towards innovation.

#### **7. International cooperation for breakthrough: network and deep connections to be established**

The element to find new materials that are totally different of what we have today lays in the root to not only invent based on what we have but getting novel materials out of experiment and simulation process. The world needs in order to win its battle against CO<sub>2</sub> by changing the paradigm of technologies.

It is proposed that the International Union of Materials Research Societies, associated with the regional member societies takes care of the world related questions, whereas the European Materials Forum will be in charge for the European materials community.

All together should cooperate within a group  
**“Coordination Research on Materials for Energy” – CORME**

#### **8. Education and Training**

Due to the complexity of the problems to be solved and their multidisciplinary, it is important to organize besides the e-learning direct contacts between industry and the research community through small sized specific exchanges and learning. A model has already been tested by IUMRS.

# Appendix 4

## ACTION PLAN FOR CORME

The participants reached the **following agreements**:

1. Agreement to enhance international research collaboration in energy-related materials research, so as to expedite progress.
2. Agreement to share results at the earliest possible stage, before publication if appropriate.
3. Agreement to meet regularly on a sector-by-sector basis to review progress.
4. Agreement to exchange knowledge and expertise (and researchers?) between laboratories.
5. Agreement to stimulate more collaborative research proposals
6. Agreement to lobby for greater national and international funding for this area.
7. Agreement to use the infrastructure of IUMRS / EMRS etc. as a framework for the organisation of focused workshops and conferences.
8. Agreement to pursue the concept of a COST-type action programme to coordinate and fund the above actions.

Proposed **Action Plan**:

### **1. ORGANISATION OF THEMATIC GROUPS FOR FUNDAMENTAL RESEARCH IN MATERIALS SCIENCE**

- A. Low Cost Components for Fuel Cells
- B. Safe Hydrogen Storage
- C. High Security Structural Materials
- D. Batteries and Supercapacitors
- E. Efficient Hydrogen Generation
- F. Materials Recycling
- G. Advanced Electronic Motors
- H. High Power Electronics
- I. Low Cost Organic Solar Cells
- J. Reinforced Composites for Aeroplanes
- K. Education and Training

### **2. PREPARATION OF A MILESTONE AGENDA FOR THESE TOPICS**

### **3. ORGANISATION OF MULTIDISCIPLINARY EXCHANGE OF INFORMATION between research, industry and education**

N.B. Concerning the NUCLEAR ORIENTED MATERIALS the international community is already organised within the "International Forum on Generation IV reactors ( president M. J. BOUCHARD) and the ITER Programme, materials division.