European Technology Platform on Advanced Engineering Materials and Technologies - EuMaT

Ivo Černý,
“main contributor” to EuMaT TP Road Map

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This contribution elaborated with the use of data presented by the EuMaT co-ordinator Aleksandar Jovanovic, MPA, Stuttgart:

EuMaT
The European Technology Platform for Advanced Engineering Materials and Technologies – Status and Prospects

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European Technology Platform for Advanced Engineering Materials and Technologies (EuMaT)

started in fall 2004 with the goal to establish the EU R&D priorities in the area of advanced engineering materials and related materials technologies, with particular emphasis on FP7
What are Technology Platforms

Technology platforms (TP’s, [http://www.cordis.lu/technology-platforms](http://www.cordis.lu/technology-platforms)) are new mechanism proposed jointly by the industry and the EU in order to define research, technology and development (RTD) priorities, timeframes and budgets on a number of strategically important issues with high societal relevance for the forthcoming RTD programs of the EU.

TP’s shall unite stakeholders around a common vision and approach for the development of the technologies concerned, with specific focus on the definition of a Strategic Research Agenda. The implementation of the research agendas should take place partly by means of existing instruments, and partly, for research agendas of high ambition, complexity and scale, by means of the new appropriate mechanism which can be set up under the provisions of Treaty Article 171. This mechanism would comprise one of the principal axes of the 7th Framework Programme (FP7).

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EuMaT was ...

- One of 25 registered Technology Platforms (TP’s) at EU...

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It should be noted however that the inclusion of a given topic does not prejudge its individual merits to be known as a technology platform. Moreover, the European Commission is not in any way bound by the views, results or recommendations arising from the activities of any of the technology platforms.

1. The European Hydrogen and Fuel Cell Technology Platform (H2P)
2. ENIAC – European Nanoelectronics Initiative Advisory Council
3. Nanomedicine – Nanotechnologies for Medical Applications
4. The Gas Cooled Reactors Technology Platform
5. Plants for the Future
6. Water Supply and Sanitation Technology Platform (WSSTP)

...
EuMaT is one of 34 registered Technology Platforms (TP’s) at EU…

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EuMaT characterisation on the basis of answers to the following questions:

- Who are EuMaT stakeholders?
- What are EuMaT priorities?
- How is EuMaT organized?
- What are EuMaT deliverables?
- What is EuMaT position in relation to other TP’s?
- What are EuMaT actions and events?
- How can one learn more about or join EuMaT?
EuMaT Issues:

• Who are EuMaT stakeholders?
• What are EuMaT priorities?
• How is EuMaT organized?
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Who are EuMaT stakeholders?

- General answer...
  - industry incl. SME’s
  - associations
  - public bodies
  - R&D
  - academia

R&D organizations, e.g.
- IPPT
- IJS
- MPA
- ONERA
- NLC
- ....

Education, Academia, e.g.
- Leuven
- Warsaw
- Stuttgart
- ....

Projects, e.g.
- Industry
- National
- Eureka
- FP5
- FP6: NoE (KMM); IP (Extremat)
- FP7 ...
- ....

Finance organizations, e.g.
- Banks
- LIFT, ....

Government Regulatory bodies, Notified bodies, Standardization organizations, society ...
- EU
- National
- Regional
- ....

Industry, e.g.
- Electronics
- Automotive
- Space
- Process
- Power
- ....

Professional Associations, e.g.
- EMRS
- EPERC
- DECHEMA
- DGM
- FDBR
- DVS
- ....

17th International Conference
Red Cc
Who are EuMaT stakeholders?

- Statistics...
  (year 2005)
  - 310 registered partners
  - 32% industry
  - 40% R&D
  - 20% HighEdu
  - 8% Other

Latest EuMaT Statistics
Status of: 01-06-05
Members total: 310 out of which 61 'core' partners

- Industry: 32%
- Res.: 39.9%
- High. Edu.: 20.6%
- Other: 7.5%

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Who are EuMaT stakeholders?

- Statistics... (year 2008)
  - 811 registered partners
  - 23% industry
  - 45% R&D
  - 23% HighEdu
  - 9% Other
EuMaT Issues:

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What are EuMaT priorities?

In EuMaT the term “Advanced Engineering Materials” refers to

- multifunctional materials for macro-applications
- multi-functional engineering materials with gradient properties
- engineering materials for challenging application conditions, including high-temperature and light-weight
- multi-material (hybrid) systems, and
  - nanomaterials in engineering components / applications / systems,

as applied/used in

- engineering (and, e.g., coupled with “conventional” structural materials like steel, aluminium, titanium, metallic alloys, composites, advanced ceramics, coatings, adhesives, …) and/or
- used to enhance the engineering products, systems and processes in areas like energy, gas & oil, chemical, space, transportation, electronics, environment, health…

In addition, EuMaT looks also at the relevant materials technologies.
What are EuMaT priorities? “3 pillars” ...

1. “KMM-Pillar”
   multi-functional engineering materials with gradient properties

2. “EXTREMAT Pillar”
   engineering materials for challenging application conditions, including high-temperature and light-weight

3. “Hybrid Pillar”
   multi-material (hybrid) systems where advanced materials are combined with more conventional / structural materials

... plus relevant materials technologies and multi-scale modelling.

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What are EuMaT priorities? Life cycle...

- cover all elements of the **LIFE CYCLE**
  of advanced engineering materials / technologies

  - Testing and characterization...
  - Use, exploitation, maintenance ...
  - Inspection, maintenance, repair...
  - Component / system manufacturing...
  - Advanced Design and modeling ...
  - Hazards, risks, impacts...
  - Recycling, decommissioning...
  - Life-cycle simulation and optimization

**EuMaT**

European Technology Platform for Advanced Engineering Materials and Technologies

SUPPORTING:

- All “steps” in the life-cycle of Advanced Engineering Materials
- All related “horizontal aspects” like education, standardization, social responsibility, databases, IT, www, publication, information dissemination...

Red Castle, Hradec nad Moravici, Czech Republic
New class of multicomponent materials formed when bonding strength between unlike atoms (e.g. Ti-Al) is larger than that between like atoms (e.g. Ti-Ti, Al-Al)

**Advantages**
- low weight
- high melting points (up to 2100 °C)
- high yield strength
- high stiffness
- oxidation resistance
- creep resistance

**Deficiencies**
- low ductility
- low fracture toughness
- high processing costs

**Applications**
- automotive industry (replacing steel)
- aerospace applications (space shuttle)
- gas turbines
- smart materials (sensors, actuators, stents)
- micro-chips and micro-machines (MEMS)
What are EuMaT priorities? Examples - MCC: METAL-CERAMIC COMPOSITES

**MCC properties:**
- enhanced strength
- low thermal expansion
- wear resistance
- good damping
- moderate density
- enhanced toughness
- good thermal & electrical conductivity

Cobalt-less metal matrix/diamond composite for high speed cutting - higher safety and healthier working place

New joining method of carbon-carbon composite to copper for ITER

Brake rotors for German high speed train ICE-2

ref. KMM-NoE
MCC properties:
- enhanced strength
- low thermal expansion
- wear resistance
- good damping
- moderate density
- enhanced toughness
- good thermal & electrical conductivity

...ITER

ref. KMM-NoE
What are EuMaT priorities? Examples:

- FGM: FUNCTIONALLY GRADED MATERIALS

**FGM:**
- Multilayer self-sealing coating for carbon-carbon composite
  - no interface
- Strengthened area

**Thermal cycling**
- Thermal aging test - no damage at 1300°C up to 120 hours

**C/C weight loss [%]**

**Time [hours]**

**Metal-ceramic FGM**

**Car engine cylinders**
What are EuMaT priorities? UK example:
Priorities driving the EuMaT Vision - UK example

- Minimisation of natural resources used and waste in extraction
- Minimisation of energy requirement throughout life cycle
- Design for performance in service, durability & recycling
- Maximisation of re-use potential in same or other products
- Minimisation of waste residues on disposal
- ...

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How is EuMaT organized?

**EuMaT Technology Platform**

- **Industrial Advisory Board**
- **EuMaT-TP General Assembly**
- **Scientific Advisory Board**
  - Operating Agent
  - Business Agent

**Steering Committee (SC)**

- Focus Groups:
  - FG I: Management and Coordination
  - FG II: Materials
  - FG III: Materials Production Technologies, Testing & Characterization
  - FG IV: Materials modeling
  - FG V: Horizontal issues

**Approval level**

**Operational level - management**

**Operational level – technical issues**

I.Černý, SVÚM a.s., Praha - contributor in FG III

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EuMaT Issues:

- Who are EuMaT stakeholders?
- What are EuMaT priorities?
- How is EuMaT organized?
- **What are EuMaT deliverables?**
- What is EuMaT position in relation to other TP’s?
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- How can one learn more about or join EuMaT?
What are EuMaT deliverables?

- 2-page form
- Vision Paper
- Terms of Reference
- SRA – Strategic Research Agenda
- Implementation Agenda
What are EuMaT deliverables?

Survey of the documents in “Road Map”

Road Map content:

- Executive summary
- 2. Realizing the Vision (“Strategic Research Agenda”)
- 3. Implementation of the SRA (“Implementation Agenda”)

Annex I: Contact points
Annex II: EuMaT Terms of Reference
Annex III: Summary of interests in EuMaT and comments regarding the partners’ wishes at the moment of joining EuMaT

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What are EuMaT (main) deliverables?

- 2-page form
- Vision Paper
- Terms of Reference
- SRA – Strategic Research Agenda
- Implementation Agenda

**EuMaT**

**Title:** EuMaT – European Technology Platform for Advanced Engineering Materials and Technologies

Detailed information on: [www.eumat.org](http://www.eumat.org)

Advanced Engineering Materials and related technologies play a crucial role in industries such as aerospace, automotive, electronics, and infrastructure. These materials have evolved dramatically in recent times as many “advanced engineering materials” have been developed in response to industry’s increasing demands for higher performance and cost-efficiency. This has become critical for companies competing on the world market, especially in fields such as high temperature materials, metallic foams, precursor-derived ceramics, corrosion resistant materials, intermetallics, multicomponent alloys, or composite technologies.

But these materials are still a challenge because of less than complete knowledge about, e.g., material degradation, technologies for production, monitoring and predicting material performance, environmental and/or health impacts.

**Overall Policy Objective:**

The main policy objective of EuMaT is to assure optimal involvement of industry and other important stakeholders in the process of establishing European R&D priorities in the area of advanced engineering materials and technologies. EuMaT should improve coherence in existing and forthcoming EU projects, and introduce “Radical Changes” and assure “Sustainable Development” in the sector of advanced engineering materials and related technologies. The term “Advanced Engineering Materials & Technologies” (AEMT) refers to:

- **multifunctional materials for macro-applications**, primarily
  - intermetallics
  - metal ceramic composites
  - functional engineering materials with gradient properties
- **engineering materials for challenging (extreme) application conditions**, including
  - self-passivating protection materials
  - radiation resistant materials
  - heat sink materials / high-temperature materials
- **light-weight materials**
- **multi-material (hybrid) systems, and**
- **nanomaterials in engineering components/applications/systems,**
What are EuMaT (main) deliverables?

- 2-page form
- **Vision Paper**
- Terms of Reference
- SRA – Strategic Research Agenda
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EuMaT Vision Paper

Contributors
Foreword
Executive Summary
1. CURRENT SITUATION / CHALLENGES
2. THE VISION
3. HOW TO ACHIEVE VISION
4. RECOMMENDATIONS
Annexes
What are EuMaT (main) deliverables?

- 2-page form
- Vision Paper
- Terms of Reference
- SRA – Strategic Research Agenda
- Implementation Agenda

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SRA Priorities

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## SRA Priorities

### Horizontal Issues:

<table>
<thead>
<tr>
<th>Topic</th>
<th>Priority</th>
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<tbody>
<tr>
<td>Material Modelling</td>
<td>62.75%</td>
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<tr>
<td>Manufacturing / fabrication related material technologies (e.g. bonding, brazing, welding...)</td>
<td>66.67%</td>
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<td>Material testing, characterization &amp; qualification</td>
<td>77.45%</td>
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<td>Impacts, risks, reliability &amp; lifecycle</td>
<td>50.98%</td>
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<td>Material data management, selection &amp; optimization systems</td>
<td>36.27%</td>
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<tr>
<td>Pre-normative work, standardization</td>
<td>26.47%</td>
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<tr>
<td>Int. collaboration, education, technology transfer</td>
<td>67.16%</td>
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</table>
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EuMaT vs. other technology platforms...

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How others (here: SustChem) see EuMaT

<table>
<thead>
<tr>
<th>Technology Platforms</th>
<th>Understanding of Structure Activity Relationships</th>
<th>Computational Material Science</th>
<th>Analytical Techniques</th>
<th>Synthesis &amp; Manufacturing of Materials</th>
<th>Products</th>
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<td>Fuel Cells</td>
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<td>Marine Transport</td>
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<td>Mobile and Wireless</td>
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<td>Innovative Medicine</td>
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<td>Animal Health</td>
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<td>Advanced Materials</td>
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<td>Gas Reactors</td>
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<td>Forestry</td>
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<td>Nanomedicine</td>
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<td>Artemis/Embedded Systems</td>
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Materials relevance: Low, Medium, High
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EuMaT Calendar

- Preparation meeting: August 2004
- Web site: September 2004
- First survey/inquiries: October 2004
- EuMaT Kick-off Meeting:
  November 29, 2004, Brussels
  hosted by BOSCH, Germany
- Establishing the TP infra-structure (web)
- Dec. 17, 2004: 1st Drafting Meeting (2 page form, Vision Paper, SRA...)
- March 1, 2005: Presentation to the Commission
- March 24, 2005: Inclusion of EuMaT into the EU list of TP’s
- May 31, 2005: 2nd Plenary (and Drafting!) Meeting
- September 2005: 3rd Drafting Meeting
- Fall 2005: "Launch Event"

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EuMaT Calendar

New events are regularly advised, e.g.

Energy Materials FP7 Workshop and brokering meeting

7th - 8th January 2008
Faculty of Engineering of Bilbao
Further Information and registration on the Tekniker website (www.tekniker.es)

FP7 General Information Meeting and EuMaT Brokerage Event

Tuesday, 20th February 2007
Wednesday (morning), 21st February 2007
Leuven (Belgium)

Wednesday morning (21st February 2007): 1st Meeting Belgian EuMaT ‘Mirror Group’ and EuMat ‘Core Group’ meeting. Attendance to the latter meetings is by invitation only. Information requests: eumat-office@technologica.org

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http://www.eumat.org/

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CONCLUSION

EuMaT is interested in and open for collaboration with all interested parties in order to jointly establish priorities and needs in Europe and communicate them efficiently to the EU and all other decision makers.

stay “tuned” at http://www.eumat.org