Impact Outlook

- 'Advanced materials and processes are at the core of many industrial sectors'
- 'EuMaT does not wait for new laws; we look into the technology, research needs, trends and opportunities for intelligent sustainable use of materials, and their availability for next generations'

Made in Europe

***Dr Winfried Keiper**, Industrial Co-Secretary, and **Dr Amaya Igartua**, Scientific Co-Secretary, discuss the activities and future directions of the European Technology Platform for Advanced Engineering Materials and Technologies (EuMaT)*

To start, what is EuMaT?

WK: EuMaT was launched as an association of industry, academia, public authorities and civil society. Its aim is to assure optimal involvement of important stakeholders in the process of establishing R&D priorities in the area of advanced engineering materials and technologies. EuMaT sets up Strategic Research Agendas and Road Maps and thereby helps the European Commission to guarantee coherence in existing and forthcoming EU Project Calls in the field of materials R&D.

Which different sectors does EuMaT work with?

WK: Advanced materials and processes are at the core of many industrial sectors. EuMaT is working, for instance, with the following sectors: transport (aeronautic, automotive, marine, railway); energy (photovoltaic, solar thermal, wind, CO_2 storage and utilisation, batteries, fuel cells, etc.); construction (energy efficient buildings, innovative materials for building and recycling); consumer goods (consumer devices, including electronics); materials for health (implants, biomaterials for health); and materials for Information Technologies and Communications (ITCs).

AI: Additionally, EuMaT follows up the actions of the Materials for Defence application, driven by the European Defence Agency (EDA), in trying to find common interests, synergies and joint activities. Similarly, we work closely with a number of materials-related industrial and scientific platforms.

Do you have examples of any salient sector-specific challenges, needs or opportunities in advanced engineered material and processes?

AI: Additive manufacturing is a materials processing technology that has the capability to create 3D components, combining single or multimaterials, nano, micro and macro materials in different processing conditions (e.g. laser assisted). The number of patents in this area has increased exponentially in recent years and the total turnover is expected to grow to more than €20 billion by 2025. The materials necessary for enabling this future development (e.g. reinforced polymers, metals, ceramics, multimaterials) require further research. For this purpose, EuMaT plans to create a new Working Group on Materials for Additive Manufacturing, which will also support lightweight and bionic designs with functional optimisations.

WK: Quantum technology is rapidly moving from low Technology Readiness Level (TRL) to concrete applications, from quantum computing through quantum sensors to cryptography. Today, most of the materials needed (e.g. nitrogen vacancy (NV) diamonds, single-isotope materials) are available only in 'handmade' laboratory amounts. Upscaling to industrial scale for future widespread applications of quantum technology is a big challenge. Equally, we need new second-generation quantum materials models that include impurities and isotope effects. Given these challenges on the materials side, we have recently founded a new Working Group on Materials for Quantum Devices.

How do you ascertain the needs of specific sectors and ensure EuMaT activities respond appropriately?

WK: EuMaT includes members from industry, the scientific community, public authorities and others. The Working Groups and our Steering Committee, which represent all these stakeholders, follow the latest trends and always keep their fingers on the pulse of the times.

AI: Members and partners continuously contribute to EuMaT's agenda. An example: the transport sector normally seeks to increase durability while reducing weight, energy consumption and emissions. Identifying materials that can achieve all these goals is challenging. One tool that can be used is tribology, the science that studies the friction, wear and durability of a specific material in a system. By reproducing the failure mechanisms of critical components (e.g. abrasion, scuffing, pitting) in the laboratory, it is possible to minimise friction and energy consumption, reduce wear

Dr Winfried Keiper studied physics and biophysics in Aachen and London, before obtaining a PhD in physics at the University of Aachen, Germany (RWTH) in 1984. He then joined Robert Bosch GmbH, the leading automotive supplier and maker of a wide range of industrial and personal products. Keiper's special technology interests include advanced materials, tribology, sensors, e-mobility, energy storage, autonomous and connected vehicles, robotics, AI, Industry 4.0 and circular economy. He has served as Co-Secretary of EuMaT since 2017.

Dr Amaya Igartua studied chemistry in the Basque Country University before obtaining a PhD in sciences at Bilbao, Spain (UPV/EHU) in 1991. She then joined Fundación TEKNIKER, a Spanish research institution of the IK4 Research Alliance that specialises in surface technologies and precision manufacturing. From 2010-2017 Igartua has been the Head of the Tribology Unit, consolidating a European reference research group that has been running for 36 years and now, she coordinates materials initiatives. She has been active in the Steering Committee of EuMaT since its creation in 2005 and has served as Co-Secretary since 2017.

to increase durability, reduce weight using surface treatments on light alloys (Al, Ti, Mg) or composites, and increase efficiency when working at higher temperatures, reducing emissions.

What would you say are some of the main challenges associated with the modelling, characterisation and scale up of today's innovative manufacturing processes? How can these issues be addressed?

WK: As far as models of manufacturing processes are concerned, we know that processing, forming, machining, cutting, heat/surface treatment, etc. have a big influence on the microstructure and thus on the macro properties of the workpiece. As a consequence, these processes need to be included in the design phase. Process models are an indispensable element of materials modelling.

AI: Modelling is a tool to reduce the number of experiments, but it is always linked to characterisation and validation. The industry will always need people working in testing, experimental validation, and measurements of material properties. But in the future, it will not be possible to make these experiments without first modelling and without pre-selection steps that include manufacturing processes. In a different arena, we will see broad applications of model-based extrapolation of testing results to the field conditions in real applications.

In what ways are lifecycle, impact and risk assessments evolving in line with developments in advanced engineered materials and processes?

AI: Products manufactured in Europe often claim to have uniquely high durability. In order to give the right value to 'made in Europe', we have to develop the right tools to assess the lifecycle of these materials and products. But the lifecycle does not finish at the end of the useful life of the product itself. A second life, repair, re-use or recycling have to be considered in the design phase in order to give life to secondary materials, assuring circularity.

WK: In a future circular economy with minimal footprint, we will probably see regulations concerning primary raw materials versus re-use of secondary materials. EuMaT does not wait for new laws; we look into the technology, research needs, trends and opportunities for intelligent sustainable use of materials, and their availability for next generations. Risk assessment of products, material content, making and handling look at both worker's protection and civil and environmental impact. It is a science of its own.

Over the next 10 years, how do you think the field of advanced engineered materials and processes will develop? Are there any particular innovations that you predict will be game-changers?

WK: We will see a big increase in computational materials science and design. Multiphysics simulation and data-driven models will be used on the microstructure level, with a clear link between microstructure and macro properties. Materials models linked to characterisation and validation will be a standard tool to design optimised, highly efficient and sustainable products.

Lastly, do you have a final message that you would like to share with readers?

WK: Information on EuMaT events, publications and more can be found at www.eumat.eu. You need to register (free of charge) to download the information. In general, dear reader: you are invited to join EuMaT actively and take part in the activities of the Working Groups! ●

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