

10 Global Materials Science and Engineering Trends

Thomas Boellinghaus and Juergen Lexow

The global challenges of our societies entail important research necessities and perspectives in the field of Materials Science and Engineering (MSE). The world-wide development in this trans-disciplinary area is continuously discussed in the World Materials Research Institutes Forum (WMRIF), the not-for-profit organization of more than 50 independent public research institutes. They will be summarized and continuously updated in the 10 Global MSE Trends. After intensive discussions among the forum members over the last two years, the first set of trends will be released in very due course and can be retrieved from the web-site wmrif.info.

For instance, the materials challenges associated with coverage of the resources for our technical products will gain increasing importance in the near future. This trend includes not only the challenges associated with providing and substitution of the materials resources for sustainable technical products, but vice versa, also the development of sustainable and environmentally compatible technical products for recovering of resources, like scarce elements and minerals, but also potable water. A further trend is based on global energy challenges. For numerous renewable energy applications materials still have to be developed that might withstand the coupled loading during the complete service life of the respective components. Photovoltaic systems at improved efficiency need to be equally adjusted more easily available materials as to climatic challenges including biostability. But, in conventional energy power stations the additional start-up and shut-down cycling as required from intermittent supply of green energy entails risky load spectra in the later stages of the service life. The respective components have not been designed for.

Mobility is a continuous societal demand, on land in the air and on water . It challenges materials both in construction and fueling. Lighter design, ease of manufacturing and recycling and in particular safe operation are on the demand side. This includes the infrastructure, roads, bridges and terminals.

Health and wellbeing in the aging society make demands on biocompatible materials in many applications; be it in implants, artificial limbs or for orthotics. It is in line with light weighting, biocompatibility and integration of electronics.

Another lasting trend in Materials Science and Engineering is the continuous need for improved instrumentation. Modeling requires elaborate and powerful computing science based on valid data. The acquisition of these data requires analytical and mechanical instrumentation that simultaneously and at improved perfection measure materials' characteristics at ever more minute dimensions.

In the lecture at MSAT 2014, the trends will be presented and, exemplarily, some of these will be outlined more detailed.