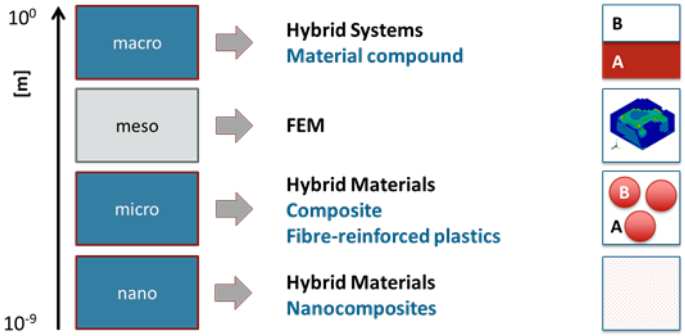
Polymer Based Hybrid Composites for Energy-Efficient Applications

Schlarb, A.K.[1,2,3,*]
[1] Chair of Composite Engineering, University of Kaiserslautern, Kaiserslautern, Germany
[2] Research Center OPTIMAS, University of Kaiserslautern, Kaiserslautern, Germany
[3] INM - Leibniz Institute for New Materials, Saarbrucken, Germany
Phone +49 631 205-5116, Fax +49 631 205-5141, [*]E-Mail: alois.schlarb@mv.uni-kl.de

Abstract

Modern components for use e.g. in mobility, energy, or building and construction have to fulfill increasing requirements regarding their performance characteristics, energy efficiency, and sustainability. Hybrid components are the solution frequently, as they show outstanding performances very often. The smart combination of different materials at different length scales can utilize the specific strengths of each component, while the respective weakness of a single component is neutralized in the hybrid. Thus, the coherent polymer matrix guarantees for example the quick and easy processing into complex structures. In contrast, the dispersed metallic or ceramic component takes over the load-bearing function. The whole is then more than the sum of the parts.

Actually, the boundaries between different material classes thereby may be overcome. What counts is the combination: the combination of materials on different scales from Nano to Macro and the combination of varying technologies for production purposes, i.e. the development and utilization of hybrid processes for manufacturing hybrid structures from hybrid materials. In this regard interfaces become more important. Actually, filling polymer materials with micro-sized fillers such as glass fibers or carbon fibers are proofed to be a very successful approach to achieve high strength and stiffness in a composite material. However, the use of nanofillers makes sense if new mechanisms in the material can be triggered and finally contribute to a better overall performance of the material.



The talk exemplary focuses on developments where the addition of fillers on different length scales lead to a significantly improved behavior of components made from thermoplastic composites. Using tribology systems as an example the enormous opportunities and mechanisms by hybrid materials and systems in generating energy-efficient solutions are demonstrated. Key-factor of the success story is the interaction of the different materials on different length scales.

Keywords: Thermoplastic hybrid composites, interaction on different length-scales, tribology