VolkswagenStiftung

Directed Thermal Transport in Hierarchical Hybrid Devices

Initiative: Lichtenberg - Professuren

Bewilligung: 21.01.2014

Laufzeit: 5 Jahre

Projekt-Website: http://www.retsch.uni-bayreuth.de/en/index.html

The vision to control the flow of heat, i.e. the transport of phonons, is termed "phononics" in analogy to electronics and will be of great importance for future technologies just as electronics have been for the past 50 years. An essential step towards the era of phononics represents the realization of a thermal diode, i.e. a material which allows the flow of heat in one direction but not into the other. This goal shall be achieved with the help of nanostructured hybrid materials. First a number of well-defined model systems are examined to understand in detail the multiple influences of internal structure and boundaries on the heat transport. In contrast to crystalline materials that have been investigated in the semiconductor industry, the professorship focuses on hybrid systems, which are composed of polymers, metals or metal oxides. The hybrid materials will be characterized in great detail with respect to their structure and function, where thermal conductivity measurements will be of primary interest. In combination with computer modeling, this will lead to a comprehensive understanding of heat transport in hierarchically structured systems. Based on this elaborated fundamental understanding of heat transfer, material and structural parameters will be derived, which will lead to the successful demonstration of a thermal diode.

Projektbeteiligte

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Hollow silica sphere colloidal crystals: insights into calcination dependent thermal transport
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Tailor-made temperature-dependent thermal conductivity via interparticle constriction
Low Thermal Conductivity through Dense Particle Packings with Optimum Disorder
Understanding Thermal Insulation in Porous, Particulate Materials