Priority Programme

“Material Synthesis near Room Temperature”

Project Description – Project Proposal

Low-temperature Synthesis of Thermoelectric Materials by Thermal Decomposition of Tailor-made Precursors in Ionic Liquids

Applicant	**Prof. Dr. Stephan Schulz**
Institution	Universität Duisburg-Essen Campus Essen Anorganische Chemie 45117 Essen Tel.: 0201/183-4635 E-Mail: stephan.schulz@uni-due.de
Applicant	**Dr.-Ing. Gabi Schierning**
Institution	Leibniz-Institut für Festkörper- und Werkstoffforschung Dresden (IFW) e.V. Institut für Metallische Werkstoffe Helmholtzstr. 20 01069 Dresden Tel.: 0351/4659-1875 E-Mail: g.schierning@ifw-dresden.de

Summary of proposal

The project will provide synthetic routes to improved - included electronically doped - thermoelectric V2VI3 (Sb2Se3, Sb2Te3, Bi2Se3, Bi2Te3 and ternary solutions) and IV-VI materials (SnSe, SnTe, PbTe) either by thermal decomposition of single-source-precursors or by reaction of highly reactive dual source precursors including reactive (metal-containing) ionic liquids (ILs) in tailor-made ILs. The precursors allow for a synthesis at low reaction temperatures and they can be tailored with respect to their physico-chemical properties (e.g. viscosity influencing mass transport rates, solubility of the different precursors etc.). In addition, they guarantee for the formation of highly stoichiometric materials, while the ILs provide control of the nano- and mesostructure. For the identification of the most promising ILs, which show the best solubility for the metal organic precursor and the weakest binding affinity to the nanoparticle surface in order to guarantee the synthesis of "naked" nanoparticles free of any surface surfactants, quantum chemical calculations will be performed by the Kirchner group (Univ. of Bonn). The full advantages of the complex synthesis using tailor-made precursors and ILs can be seen in the thermoelectric transport

properties of the compacted nanopowder. Therefore, the determination of the most important thermoelectric properties such as Seebeck coefficient, power factor as well as thermal and electrical conductivity is essential for the successful determination of the most suitable precursors, ILs and synthesis conditions.