

Priority Programme

“Material Synthesis near Room Temperature”



Project Description – Project Proposal

Low-Temperature Approach to Solvent-Free Chalcogenidometallate Materials

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Summary of proposal

Based on our successful application of a variety of syntheses routes into functional crystalline chalcogenides, and with the specific recent knowledge that we gained in the field of ionothermal syntheses of a diversity of porous chalcogenide frameworks, we intend to further develop and expand our research with the intention to establish low-temperature approaches into solvent-free, crystalline chalcogenidometallate phases $[\text{Cat}]_q[(\text{M}')_x\text{T}_y\text{E}_z]$ (Cat = (element-)organic or metal cation, M = transition metal; M' = Hg, Pb, Bi; T = Si, Ge, Sn; E = S, Se, Te). For this, we will focus on three different general directions:

1) Low-temperature generation of solvent-free salts of ternary or multinary chalcogenidometallates as opto-electronic or magnetic materials. 2) Development of pseudo-flux reaction conditions for the low-temperature synthesis of solvent-free lithium chalcogenidometallates. 3) Synthesis of porous and nano-structured chalcogenidometallates for thermoelectric materials and transport.

Against the background that the materials obtained in ILs might become useful for technical applications, we will prefer elemental combinations with sustainable, lower-toxic and fairly cheap elements, such as Li, Na, K, Sn, P, or S; employment of heavier elements M' will be restricted to the achievement of particular opto-electronic or thermoelectric properties. All reactants (new precursors and products) will be subject to thorough characterization and analysis of specific properties by using a multitude of experimental and theoretical methods.