Priority Programme

“Material Synthesis near Room Temperature”

Project Description – Project Proposal

Multifunctional Soft Materials from and with Borate Ionic Liquids and Lanthanides

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Summary of proposal

The objective of this joint research project is the synthesis of novel soft materials by a combination of a distinct set of borate ionic liquids (ILs) with lanthanide and group 3 metal ions. Thereby, the project aims at a combination of properties originating from the components of the ILs, with a focus on the borate anions, and Ln metal ions. Especially the combination of the different building blocks will help to implement properties such as a tuneable luminescence, ionic character, hydrophobicity, and electrochemical stability for a potential multifunctionality of these materials. Studies on the luminescence and the setting of hydrophobicity have been carried out successfully in the first project period and more than 50 new coordination compounds, polymers, and metal-organic frameworks (MOFs) that contain lanthanide ions and components of the ILs have been synthesized with and from spiro-borate and cyanoborate ILs. They exhibit remarkable luminescence properties showing a distinct influence of the borate anions. Based on the strong beneficial impact of reactions in and with the respective ILs, an enlarged and carefully adjusted set of ILs will be used in the new period. Thereby, the successful dual path of homogenization by dissolution of metal and metal salts in the ILs as well as heterogenization by formation of novel solid products will be addressed and developed further. Selected reactions will also be carried out in the presence of additives like linkers to improve the accessibility of metal-organic frameworks with the set

of borate ILs. The new compounds will be investigated concerning their electrochemical properties (electrochemical stability, conductivity, and polarizability) and selected materials properties (chemical stability and thermal properties, viscosity, and potential porosity). The study on efficient and tuneable luminescence and the respective mechanisms will be developed further on efficient sensitization and chromaticity control and the influence of other chemical species on the luminescence itself. The latter will be used to investigate sensing possibilities based on a dependence of the interaction with these species on the luminescence of the new soft materials. Thereby, also the far goal of the initial application shall be achieved.