Poster Presentation

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Categorization of electrochemical storage materials en route to new concepts

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Because of their broad range of applications, electrochemical energy storage devices are the subject of a growing field of science and technology. Their unique features of high practical energy and power densities and low prices allow mobile and stationary applications. A large variety of electrochemical systems has been tailored for specific applications: Lithium-ion batteries for example have been optimized for mobile applications ranging from mobile phones to electric vehicles. On the other hand, sodium-sulphur accumulators – among others – have been developed for stationary applications to account for the capricious nature of renewable energies. Chemistry, physics and materials science have led to the optimization of existing cell-chemistries and the development of new concepts such as all-liquid or all-solid state batteries as well as high-energy density metal-air batteries. The aim of the BMBF (Federal Ministry of Education and Research, Germany)-financed project "CryPhysConcept" is to develop new concepts for electrochemical energy storage applying a crystallographic approach. First, a categorization of the main solid components of batteries based on their underlying working principles is suggested. Second, an algorithm for the identification of suitable new materials and material combinations, based on economical, ecological and material properties as well as crystallographic parameters, is presented. Based on these results, new concepts using multi-valent metal ions are proposed. Theoretical as well as experimental results including an iron-ion approach are presented.

Keywords: electrochemistry, battery, energy-storage