Poster Presentation

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Energy Storage in crystalline Materials based on multivalent Ions

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Energy conversion and storage has become the main challenge to satisfy the growing demand for renewable energy solutions as well as mobile applications. Nowadays, several technologies exist for the conversion of electric energy into e. g. heat, light and motion or vice versa. Among a large variety of storage concepts, the conversion of electrical in chemical energy is of great relevance in particular for location-independent use. Main factors that still limit the use of electrochemical cells are the volumetric and gravimetric energy density, cyclability as well as safety. The concept for a new thin-film rechargeable battery that possibly improves these properties is presented. In contrast to the widespread lithium-ion technology, the discussed battery is based on the redox reaction of multivalent Al-ions and their migration through solid electrolytes. The ion conduction and insertion processes in the crystalline materials of the suggested cell are discussed under a crystallographic point of view to identify suitable electrode and separator materials. A multilayer-stack of all-solid-state batteries is synthesized by pulsed laser deposition and investigated in situ, i. e. during charge and discharge, by X-ray reflection and diffraction methods. The correlation between crystal structure, morphology and electrical performance is investigated in order to characterize the ion diffusion and insertion process.

Keywords: thin-film battery, electrode materials, solid electrolyte