THE ALUMINUM-ION BATTERY – MATERIALS AND PERSPECTIVE

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The expansion of renewable energies and the growing number of electric vehicles and mobile devices demand for improved and low-price electrochemical energy storage with highest energy densities, readily available raw materials, and safety. Prospectively, lithium, cobalt and phosphorous may show substantial supply challenges. Therefore, the search for new chemistries will become increasingly important in order to diversify battery technologies.

Using a selection algorithm[1], for evaluation of suitable materials, the concept of a rechargeable aluminum-ion and thus high-valent ion all-solid-state battery appears promising. Metallic aluminum is used as the negative mass. This offers the advantage of a four times higher volumetric capacity compared to the lithium analogue. So far, the technological potential has not been exploited, as suitable materials are still lacking[2]. With crystallochemical analyses[2,3], we identify and present promising material candidates (e.g. $AlVO_3$, Al_2Se_3, or AlI_3), and discuss the current state of the aluminum-ion battery.

This work is funded by the German Ministry of Science and Education (R2R-Battery: 03SF0542A), G-RISC (P-2018a-9), and the Russian Ministry of Science and Education (project: 3.6588.2017/9.10 and 3.7626.2017/9.10).

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