New electrolytes for rechargeable multivalent metal-sulfur batteries

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Fluorinated alkoxyborates based magnesium electrolytes are weakly coordinated systems, which exhibit a high anodic stability (4.3 V vs. Mg, on stainless steel), high ionic conductivity (10 mS/cm) and high Coulombic efficiency (>99%) of reversible magnesium deposition.[1,2] Owing to the non-corrosive, chemically stable nature and the robust, economic synthesis in one step from commercially available materials, this design concept of new, weakly coordinated ion conducting salts opens a promising avenue towards the realization of high-energy batteries based on multivalent ions.
Synthesis, chemical and structural analysis and electrochemical properties will be presented. The data of metal-sulfur batteries will be shown where the new electrolyte leads to better cycling behavior and to a lowering of overpotentials. Improvements were made also in the architecture of the battery cell, by using an optimized carbon scaffold in the cathode and a coated separator, leading to a remarkable improvement in the cycling stability of Mg-S full cells.

References:

1. *New class of non-corrosive, highly efficient electrolytes for rechargeable magnesium batteries*, Zh. Zhao-Karger, E.G. Bardaji, Olaf Fuhr, and M. Fichtner, J. Materials Chem. A 5 (2017) 10815-10820
2. *Prospective Article: Magnesium–sulfur battery – its beginning and recent progress*, Z. Zhao-Karger and M. Fichtner, MRS Communications 7,4 (2017) 770-784