Opportunities and challenges of multivalent batteries

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Magnesium, calcium and aluminum are promising elements for future batteries due to the high gravimetric and volumetric capacities of metals. All three elements are highly abundant in the earth's crust whit homogenous distribution on the globe. They are considered sustainable elements for batteries used in renewal energy storage.
Besides the above-mentioned benefits, there are several challenges connected with stripping and deposition of the metals, with the appropriate electrolyte formulation compatible with the metal anode and potential cathode materials, with current collectors, the housing of the cell and with the choice of appropriate cathode materials. Cathode materials allowing insertion of cations as we are using them in Li-ion batteries have limited applicability with multivalent cations. More appropriate are cathode materials that allow coordination redox reaction or conversion redox reaction. Among those, the highest applicability can be obtained with redox-active polymers and sulfur-based cathodes.
In this presentation, an overview of recent achievements in our group in the field of multivalent batteries will be discussed with a focus on the proper selection of battery components in order to achieve electrochemical properties attractive for commercialization.

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