# DEVELOPMENT OF CALCIUM-SULFUR BATTERIES AND THE PURSUED APPROACHES WITHIN THE CASINO PROJECT

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Among the various post-lithium battery cell chemistries, the electrochemical couple of calcium and sulfur in a Ca-S cell represents an appealing yet challenging candidate. It combines potential advantages over lithium-ion batteries in terms of costs, safety and recyclability, while offering high theoretical energy densities of 1835 Wh/kg and 3202 Wh/l. However, due to the low redox potential of Ca metal (-2.87 V vs. SHE), reduction of species at its surface is likely and consequently compatible electrolytes are rare.

The BMBF-funded CaSino project consists of a complementary consortium of research institutes (DLR, fem, NMI), universities (KIT, UUlm) and industry (IoLiTec GmbH, EurA AG) which pursues different approaches to tackle the main obstacles to realize a high-energy Ca-S pouch cell. Specifically, thin calcium metal foils are desired to minimize the anode excess, an artificial SEI is introduced to mitigate the polysulfide shuttle, and the electrolyte composition is improved towards enhanced SEI formation and cathode redox kinetics. In addition, DFT and continuum simulations try to shed light on the interfacial and transport processes and to accelerate the material development. Assisted by a life cycle assessment analysis, the CaSino project finally aims to demonstrate the potential of the Ca-S system as sustainable high-energy battery.

Within CaSino, DLR has extensively investigated the similarities and differences of Li, Mg, and Ca electrolytes and anodes concerning transport properties as well as charge transfer and interfacial processes, respectively, using galvanostatic polarization and electrochemical impedance spectroscopy.