Integration of Aramid Oligomers into Polymer-Based Solid Electrolytes for Lithium-Sulfur Batteries with Enhanced Stability for Aviation

Project Description

This project aims to address the challenges faced by all-electric short-range aircraft by developing high-performance all-solid-state lithium-sulfur batteries with enhanced stability and energy density. One of the challenges is the rapid degradation during operation over repeated cycles, mainly attributed to the polysulfide shuttle effect. To address this issue, it is crucial to design, synthesize, and characterize novel composite solid electrolytes that can effectively inhibit the polysulfide shuttle. Based on a high-performance cross-linked polymer electrolyte that was developed in our group[1] within the first phase of the Excellence Cluster SE^{2}A, the improvement of the stability by incorporation of aramid oligomers and polymers into the electrolyte shall be investigated. After the preparation of suitable electrolyte films, the components will be assembled into battery cells, and their electrochemical performance will be evaluated and correlated with material properties. Upon completion of this project, we expect to gain valuable insights into the degradation mechanisms of all-solid-state lithium-sulfur batteries and identify innovative materials to enhance their performance.

This project is set within a highly interdisciplinary environment at the Battery LabFactory Braunschweig, a research center of TU Braunschweig. It will involve the following tasks:

- *Synthesis of novel polymer-based composite electrolytes with aramid oligomers and polymers integrated into cross-linked PETEA-based polymers*
- *Fabrication of lithium-sulfur battery cells (coin cells) based on the synthesized composite electrolytes and sulfur-carbon composite cathodes*
- *Characterization of the materials and the battery performance*

Requirements

- *We seek a highly motivated candidate with a degree at Master's level (or equivalent) in Material science, Chemistry, and Chemical Engineering or another relevant discipline*
- *Experience in electrochemistry and material characterization is highly advantageous*
- *You must show a strong interest in battery research and materials processing and should possess extensive laboratory experience in materials synthesis and battery assembly*

[1] E. J. Jeon, A. Jean-Fulcrand, A. Kwade, G. Garnweitner, *Nano Energy*, **104** (2022), https://doi.org/10.1016/j.nanoen.2022.107912

- *We expect excellent English language skills as well as basic German knowledge or willingness to acquire basic language skills*
- *You should be a good team-worker and possess great observational and communication skills*

Contact information

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https://www.tu-braunschweig.de/ipat

https://www.tu-braunschweig.de/se2a/open-positions/student-positions/international-female-programme-research-internships

Employment

The entry date is as soon as possible, and the duration of employment is limited to 6 months. The position is part-time with 50% of the regular weekly working time (currently 19.9h). Ongoing applications are possible until all positions are filled.

The payment is made according to task assignment and fulfillment of personal requirements to salary group EG 13 TV-L. International applicants may have to successfully complete a visa process before hiring can take place. Candidates with handicaps will be preferred if equally qualified. Please enclose a proof. The position is part of the SE²A International Female Programme, so only applications by female graduates of non-German universities are possible.

All documents should be in PDF format, preferably in a single file. Personal data and documents relating to the application process will be stored electronically. Please note that application costs cannot be refunded.