

Project Title: *Oxyhydrides as Solid-state Electrolyte Materials*

Thesis Location: Materials for Energy Conversion and Storage (MECS) – Applied Sciences

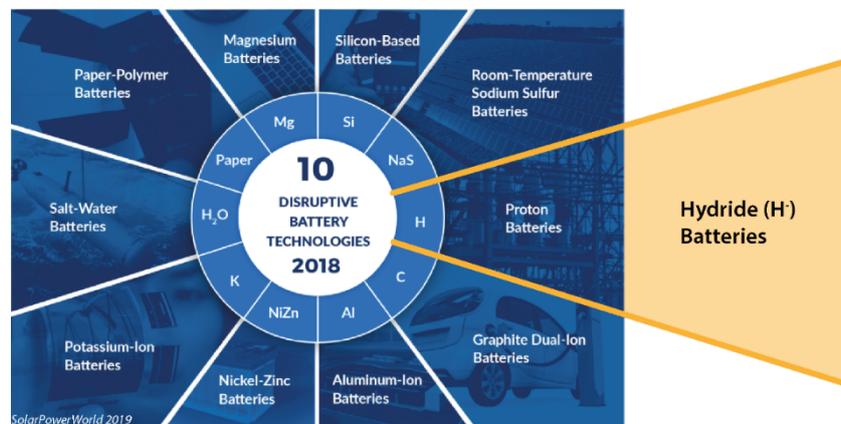
Daily Supervisor: Diana Chaykina

Supervisor: Bernard Dam

Scope of the Research Challenge:

Our group focuses on two ways to contribute to the ongoing energy transition: (1) solid-state energy storage and (2) smart windows for efficient energy use. This project focuses on the former. Although Li-based batteries have been the powerhouse of energy storage, there are several problems with them including unethical mining of limited Li and Co resources, Li safety, and difficulty in recycling. Nothing will replace Li-batteries completely, but it is important to search for alternatives.

Beyond Lithium Landscape:



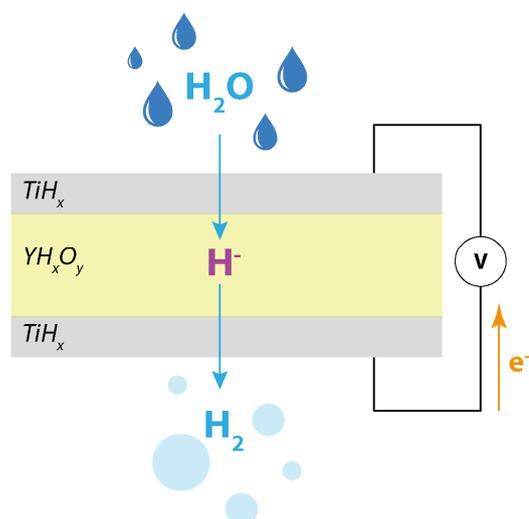
Batteries consist of electrodes separated by an electrolyte. We work specifically on solid-state electrolytes which conduct hydride (H⁻) ions instead of Li⁺, and can be used for intermediate temperature fuel cells or electrolyzers. Novel materials known as *oxyhydrides* have been shown to be efficient H⁻ conductors. We are trying to find which oxyhydrides are the best ionic conductors, how to produce these materials, how to influence their ionic conductivity by materials manipulation, and what the diffusion pathway for the ion is.

What will you be doing?

In this project we would like to tackle the problem of:

- Understand & perform **thin-film deposition** of multi-anion materials by reactive magnetron sputtering
- **Optical** characterization of electronic bandgaps
- **X-ray Diffraction** to determine crystallographic structure
- **SEM-EDX** to understand morphology and elemental distribution
- AC and DC electrical measurements to understand ionic and electronic conductivities under various temperatures and conditions
- Specifically, **electrochemical impedance spectroscopy** and Van der Pauw conductivity characterization

Oxyhydride Battery:



What do we require of you?

We expect that you

- will be enthusiastic and eager to learn about the field you are working in
- will maintain a safe working environment and learn about the standards in the lab
- will show a great deal of autonomy by the end of your project

What can you expect of your work situation?

During the period of your thesis you will be based at the university working within the larger MECS group. Throughout the project you will learn to organize and communicate the results to your peers through 2 presentations to the group, and the writing of a thesis report. Together this will take approximately 7 months at full-time (38 hours/week).

The MECS group also has an inviting coffee break together every day at 10:30, and a borrel every Wednesday at 17:00. Once you're a part of the group we encourage you to join and discuss life and work with your new colleagues!

Interested in this thesis end project?

Please contact the daily supervisor at the details below to arrange for a discussion about the project!

Contact [Diana Chaykina](mailto:d.chaykina@tudelft.nl) at d.chaykina@tudelft.nl