InterPore2021



Contribution ID: 460

Type: Oral Presentation

Evaluation of the Impact of Flow Field Design on the Porosity of Zinc Deposition in the Zinc-Iodide Flow Battery by X-ray Computed Tomography

Monday, 31 May 2021 15:40 (15 minutes)

Among the aqueous redox flow battery systems, redox chemistries using a zinc negative electrode have a relatively high energy density [1]. In this study, a new flow field design was applied in a zinc-iodide flow battery, with some of the electrolyte flowing over the electrode surface, and a fraction of the flow passing through the porous felt electrode in the direction of current flow. The flow battery was tested under constant current density and the efficiency, discharge energy density and power density of the battery were improved compared to conventional flow field designs. The morphology of the zinc deposition was studied using scanning electron microscopy and optical profilometry. It was found that the flow through the electrode led to a thinner zinc deposit with lower roughness on the surface of the electrode, in comparison to the case where there was no flow through the electrode.

During the charging process, metallic zinc is electroplated on the porous graphite felt in the negative side of the battery [2]. Ex-situ tomographic measurements were used to image the zinc particles on the surface and inside the porous felt qualitatively and quantitatively. Information of porosity, thickness and distribution of the zinc in the porous felt were obtained from x-ray computed tomography (XCT) images. Volume rendering of graphite felt from XCT images showed that in the presence of flow through the electrode, more zinc deposition occurred inside the porous felt, resulting in a thinner surface deposit, and higher battery capacity and improved performance.

[1]- Khor, A., P. Leung, M. R. Mohamed, C. Flox, Q. Xu, Liang An, R. G. A. Wills, J. R. Morante, and A. A. Shah. "Review of zinc-based hybrid flow batteries: From fundamentals to applications." Materials today energy 8 (2018): 80-108.

[2]- Li, Bin, Zimin Nie, M. Vijayakumar, Guosheng Li, Jun Liu, Vincent Sprenkle, and Wei Wang. "Ambipolar zinc-polyiodide electrolyte for a high-energy density aqueous redox flow battery." Nature communications 6, no. 1 (2015): 1-8.

Time Block Preference

Time Block A (09:00-12:00 CET)

References

Acceptance of Terms and Conditions

Click here to agree

Newsletter

Student Poster Award

Primary authors: Ms SHAKERIHOSSEINABAD, Fatemeh (PhD Candidate); Dr RANDJBAR DAEMI, Sohrab (Post Doctoral); Prof. SHEARING, Paul (Professor at the Department of Chemical Engineering); Prof. P.L.ROBERTS, Edward (Ted) (Perofessor at the Department of Chemical and Petroleum Engineering)

Presenter: Ms SHAKERIHOSSEINABAD, Fatemeh (PhD Candidate)

Session Classification: MS19

Track Classification: (MS19) Electrochemical processes in porous media