Contribution ID: **214** Type: **Poster (+) Presentation**

Multiphysics modeling of vanadium redox flow batteries.

Tuesday, 1 June 2021 19:00 (1 hour)

Porous electrodes are an essential component of Vanadium Redox Flow Batteries (VRFBs), which are one of the most promising technologies among the energy storage systems required for the integration of the growing supply of renewable energies into the electric grid. Vanadium RFBs have been engineered for decades and currently exhibit some early commercial scale implementations. In this context, mathematical modelling offers a great opportunity for the optimization of current VRFB performance [1-5].
In this work, a two-dimensional, macroscopic, isothermal, steady-state model of a VRFB cell is presented. It incorporates comprehensive descriptions of charge transport and mass transport of ionic species in the electrolyte and membrane, as well as of the electro-chemical kinetics in the porous electrodes. The resulting model enables an extensive understanding of the coupled phenomena that take place in VRFBs, being able to predict the performance under different operating conditions and to identify the critical parameters for the optimization of the cell design.
The electrolyte properties are characterized as a function of the State of Charge (SOC) using in-house experimental data, thus providing a more accurate description of species transport. The computed ionic conductivities are corrected and compared with experimental measurements. Besides, an experimental campaign was conducted to validate the model. Polarization curves are obtained at ambient temperature varying operating conditions such as SOC and volumetric flow rate, and OCV data is obtained as a function of the battery SOC.

Time Block Preference

Time Block C (18:00-21:00 CET)

References

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[3] D. You et al., Electrochim. Acta 54, 6827-6836 (2009).
[4] Q. Xu et al., Prog. Energy Combust. Sci.49, 40-58 (2015).
[5] X.L. Zhou et al., Appl. Energy 158, 157-166 (2015).

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