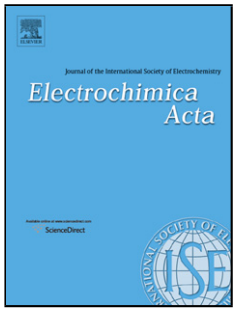

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Author: Dandan Chu Xin Li Shu Zhang

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A non-isothermal transient model for a metal-free quinone–bromide flow battery

Dandan Chu, Xin Li*, Shu Zhang

Beijing Key Laboratory for Chemical Power Source and Green Catalysis, School of Chemical Engineering and the Environment,

Beijing Institute of Technology, 100081 Beijing, China

*Corresponding author: Email:klkxlx@163.com, Tel: +86-10-68918978

Abstract: An enhanced non-isothermal transient model for a metal-free quinone–bromide flow battery is developed. The graphite plate and channel are also included in the geometric model to represent an actual cell more accurately and increase the generality and usefulness. Rather than applying Darcy's law typically used in a two-dimensional model to calculate the relation of velocity and pressure, we applied the Brinkman equation to handle the interface between the porous electrode and channel. The model includes a comprehensive description of energy transport and presents time-dependent characteristics of voltage and overpotential changes. The performance changes at different applied current density, temperature and flow rate values are also investigated. At a low applied current density, the flow rate has little effect on cell performance. The voltage and overpotential increase followed by a small increase with the increase in temperature. The current density distribution indicates the importance of cell structure optimization. The model is validated using data obtained from experiments in the literature. The model may be used to predict the cell performance and enable the development of a quinone–bromide flow battery.