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Vanadium liquid flow battery self-discharge rate

Overview

The self-discharge process of vanadium flow battery (VFB) assembled with Nafion 115 is investigated in very detail for the first time. The self-discharge phenomenon of VFB is closely related to the diffu.

How to predict self-discharge process in a kilowatt-Class vanadium redox flow battery stack?

A simple mathematical model is established to predict the self-discharge process in a kilowatt-class vanadium redox flow battery stack. The model uses basic mass transport theory to simulate the transfer of vanadium ions in the battery. The simulation results agree reasonably with the experimental values, confirming the validity of the model.

What is a vanadium redox flow battery?

A vanadium redox flow battery (VRFB) is an intermittent energy storage device that is primarily used to store and manage energy produced using sustainable sources like solar and wind. In this work, we study the modeling and operation of a single-cell VRFB whose active cell area is 25 cm \ (^2\).

What factors contribute to the capacity decay of all-vanadium redox flow batteries?

Learn more. A systematic and comprehensive analysis is conducted on the various factors that contribute to the capacity decay of all-vanadium redox flow batteries, including vanadium ions cross-over, self-discharge reactions, water molecules migration, gas evolution reactions, and vanadium precipitation.

What is a practical vanadium redox flow battery (VRFB) system?

Understanding the practical vanadium redox flow battery (VRFB) system is a complex task due to the intricate nature of mathematical modeling that incorporates principles of chemical reactions and physical laws, as explored by Bromberger et al. [34, 35].

Does the diffusion rate of vanadium ions depend on partition coefficient?

The simulation results agree reasonably with the experimental values, confirming the validity of the model. It is found that the diffusion rate of vanadium ions depends on the diffusion coefficient, the partition coefficient and the concentration gradient of the vanadium ions between the two half cells.

What is the net transfer direction of vanadium ions?

For the self-discharge process at the initial SOC of 0, the net transfer direction of vanadium ions is towards the negative electrolyte until the diffusion rate of V 3+ becomes quicker than that of VO 2+. Both the diffusion rate of V 3+ and VO 2+ decrease with time due to the decrease in the concentration gradient between the two half cells.

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