

Chemical reactions of vanadium flow batteries





Overview

What is vanadium redox flow battery (VRFB)?

The vanadium redox flow battery (VRFB) is one promising candidate in large-scale stationary energy storage system, which stores electric energy by changing the oxidation numbers of anolyte and catholyte through redox reaction.

Are vanadium redox flow batteries safe?

The vanadium redox flow battery is one of the most promising secondary batteries as a large-capacity energy storage device for storing renewable energy [1, 2, 4]. Recently, a safety issue has been arisen by frequent fire accident of a large-capacity energy storage system (ESS) using a lithium ion battery.

Are there hydration structure differences between vanadium ion and water molecules?

There are hydration structure difference between vanadium ion and water molecules. Vanadium redox flow batteries (VRFBs) have been highlighted for use in energy storage systems. In spite of the many studies on the redox reaction of vanadium ions, the mechanisms for positive and negative electrode reaction are under debate.

How absorbed vanadium ions are connected to the electrode?

The absorbed vanadium ions are connected to the electrode through the exchange with functional group hydrogen ions. In the second step, the electron and oxygen transfer reactions occur in the $\text{VO}^{2+}/\text{VO}^{3+}$ redox couple, and only the electron transfer reaction occurs in the $\text{V}^{2+}/\text{V}^{3+}$ redox couple.



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