Characteristics and performance of 5kW class vanadium redox flow battery stack

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Since the first concept of redox flow battery was reported in 1973 by L.H. Thaller in the NASA, Redox flow battery systems are being developed for use in stand-alone village power applications and distributed energy installations for electric utility services. The redox flow battery enables energy to be stored in two solutions (i.e., anolyte and catholyte) that contain different redox couples with electrochemical potentials that are sufficiently separated from each other to provide an electromotive force to drive the oxidation/reduction reactions. Thus, these batteries offer considerable advantages of long life time, quick response time, deep-discharge capability and low maintenance cost. [1, 2]
Several Redox flow battery electrolytes have been proposed, such as all vanadium, iron/chromium, zinc/bromine and zinc/cerium and so on.
Among them, all vanadium redox flow battery (VRFB), using the same metal in both half-cells [V^{2+}/V^{3+}] as negative electrolyte and [V^{4+}/V^{5+}] as the positive electrolyte. overcame the problem of electrolytes cross-contamination through the ion exchange membrane. Based on these attractive features, more and more attentions have been paid to VRFB recently.
In this research, a 5 kW-class VRFB system is fabricated to investigate the effects of electrolyte flow rate and performance of VRFB at different current. The stack was manufactured by pressing the 50 VRFB single cells. The effective are of each electrode was 1145cm^2. For each single cell, it was prepared with two carbon felt electrodes at each side of the ion exchange membrane as positive electrode and negative electrode, respectively, graphite bipolar plates, PVC frames and gaskets. Properties such as long-term cycle life and resistance are presented.

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