Catalytic production of high-quality $V^{3.5+}$ electrolyte for vanadium redox flow battery

허지윤, 김희탁†
KAIST
(heetak.kim@kaist.ac.kr†)

Although the vanadium redox flow battery (VRFB) is the most promising candidates for the use in large-scale energy storage systems, commercialization of VRFB is yet hindered by the high cost of vanadium electrolyte since the production of electrolyte requires an inefficient electrolysis. In this work, we propose a simple chemical method for producing a high-quality $V^{3.5+}$ electrolyte by employing organic fuel cell catalysts. The new method uses a catalyst and an organic reducing agent (ORA) to chemically reduce V^{4+} to V^{3+} without releasing any undesired impurities. Among the ORAs, formic acid has the fastest reaction kinetics when it is used with Pt based catalysts (Pt/C or PtRu/C). PtRu/C has higher activity than Pt/C, albeit the dissolution of Ru impinged cell performance by causing severe hydrogen evolution reaction. By using Pt/C and formic acid, an impurity-free $V^{3.5+}$ electrolyte was successfully produced and superior VRFB performance was achieved. Based on the result, a lab-scale catalytic reactor was designed, and continuous production of impurity-free $V^{3.5+}$ electrolyte was demonstrated. This new practical method can reduce the production cost of VRFB electrolyte by ~ 40%.