Preparation of Electrolyte with Thermal Stability Using Mixing Additives for Vanadium Redox Flow Battery

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바나듐레독스 흐름전지용 혼합첨가제를 이용한 열안정성 전해액의 제조

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Abstract

Sodium pyrophosphate dibasic (SPD) and Formic acid(FA) have been used as additive to improve its stability of electrolyte at 60℃ and to investigate influence of mixed additives on electrochemical properties for all vanadium redox flow battery. Vanadyl sulfate was added to 3.0M sulfate acid to obtain a 1.6M $VOSO_4$+3MH_2O electrolyte solution. SPD and FA were mixed with the electrolyte to prepare V^{4+}/SPD and V^{4+}/SPD/FA, and then stirred during overnight to get homogeneous electrolyte solution. V^{5+} electrolyte solution was prepared through charge-discharge process. Their electrochemical behaviors in the V^{4+} electrolyte with SPD and FA were studied by cyclic voltammetry(CV) and electrochemical impedance spectroscopy(EIS). Also, the cycle ability of single ‐cell VRFB with each electrolyte for pristine, SPD and SPD/FA was tested. The results of three systems were presented energy efficiency(EE), voltage efficiency(CE), columbic efficiency(CE). It can be seen that the electrolytes of the SPD system and SPD/FA system are significantly improved in terms of CE and VE compared to the pristine. CE increased depending on the system in order of 91.5%, 96.5% and 97.7% corresponding to the pristine, SPD system and SPD/FA system respectively.

keywords : Vanadium redox flow Battery(VRFB), V(V) electrolyte, Sodium pyrophosphate dibasic(SPD), Formic acid(FA), Cyclic Voltammetry(CV),