Title: MoO2–graphene nanocomposite as an electrocatalyst for high-performance vanadium redox flow battery

Authors: Bayeh, Anteneh Wodaje; Ou, Yang-Yi; Ou, Yun-Ting; Chang, Yu-Chung; Chen, Hsueh-Yu; Wang, Kai-Chin; Wang, Yao-Ming; Huang, Hsin-Chih; Chiang, Tai-Chin; Kabtamu, Daniel Manaye.

Abstract

MoO2–reduced graphene oxide composite (MoO_2–rGO) acts as the electrode material for all-vanadium redox flow battery (VRFB). MoO_2–rGO composite exhibits excellent electrocatalytic redox reversibility for V^{3+}/V^{2+} and VO^{2+}/VO^{2+} and larger anodic and cathodic peak currents than those of other individual MoO2 and rGO samples. The voltage efficiency of the VRFB using MoO_2–rGO nanocomposite at 80 mA cm^{-2} is 82.14%, which is 4.23% and 13.56% higher than the VRFBs using the rGO-coated graphite felt electrode and the graphite felt electrode, respectively. It still shows the voltage efficiencies of 73.83% and 68.50% at 120 mA cm^{-2} and 140 mA cm^{-2}, respectively, but other samples have no effective discharge. This improvement is attributed to the uniform distribution of MoO_2 nanoparticles on the rGO surface, avoiding the restacking of the rGO sheets and suppressing nanoparticle aggregation, which might increase the effective surface area and improve mass transport at the electrode-electrolyte interface. Furthermore, oxygen vacancies on MoO_2, the high electrical conductivity of rGO, and the high content of oxygen functional groups act as active sites for the vanadium ion redox reaction.

Keywords: Vanadium redox flow batteryMoO2 reduced graphene oxide MoO_2–rGO nanocomposite

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