

A vanadium redox flow battery using carbon fiber paper electrode decorated with gold nanostructures

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Key components of the all-vanadium redox flow battery (VRB) are electrolytes containing a vanadium redox couple, membrane, bipolar plate, and electrode. Among them, the electrode should possess higher electronic conductivity and electrochemical properties in acidic electrolytes. To prepare a novel composite electrode for VRB system, Au nanostructures were synthesized on a carbon fiber paper via potential pulse electrodeposition. High potential nucleation pulse and longer growth pulse steps were repeated with a certain pulse pairs. After electrodeposition, a large number of Au nanoparticles were synthesized, and aggregations of these nanoparticles formed well-defined flower-like Au dendrites on the surface of the carbon fiber. The prepared composite electrode showed high electroactive surface areas and low electron transfer resistance determined by cyclic voltammetry and impedance spectroscopy. A VRB single cell employing the flower-like Au-decorated carbon fiber paper electrode showed enhanced performance with increased discharge time, coulombic efficiency, and capacity.