IMPROVING ELECTRODE ACTIVITY IN A SEMI-CE–I REDOX FLOW BATTERY BY SOL-GEL AND ELECTROLESS DEPOSITION METHODS

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Abstract - The energy of a redox flow battery (RFB) is stored in separated positive and negative electrolytes on the electrodes, which provide the driving force that initiates the oxidation–reduction reaction. We developed a novel cerium/iodine-vitamin C redox flow battery (Ce/I-VRFB) with iodine (I2), vitamin C, and cerium (Ce) salt, and using modified electrodes. The Ce (III)/Ce(IV) redox couple has a high standard potential, but its electrochemical reversibility is poor. In order to increase the energy storage efficiency of the Ce/I-VRFB, we modify the anode electrode by the electroless plating and sol- gel methods to enhance electrochemical activity. The basic characteristics of the modified electrodes, such as the surface structural morphology, metal crystal phases, and electrochemical properties, were verified through cyclic voltammetry (CV), field emission-scanning electron microscopy and energy-dispersive X-ray spectrometry (SEM/EDS), and X-ray diffraction. Results imply that the C–TiO2–Pd electrode has a ratio value (1.08) of symmetric redox currents, which was close to unity, meaning that this is a reversible redox reaction for theCe (III)/Ce(IV) redox couple. In addition, the C–TiO2–Pd electrodepresented high diffusion coefficient (Do) and electric double layer capacitor values (Cd), which can enhance the electrocatalytic effect of the electrode. Consequently, the C–TiO2–Pd electrode performed better in the redox kinetic reaction and can be expected to effectivelyimprove the energy storage ability of Ce/I-VRFB system.

Keywords - Cerium/iodine-vitamin C redox flow battery; electroless plating;electrodes;diffusion coefficient