

Photo-assisted charge/discharge of a secondary cell of α -Fe₂O₃/Prussian blue–based electrodes

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Abstract

In this work, an assembly of FTO/ α -Fe₂O₃/PB|M⁺ electrolyte|PB/ α -Fe₂O₃/FTO (M⁺ = Li⁺, Na⁺, K⁺) secondary photocell was done to improve the charge capacity in the presence of illumination. Our previous results with these electrodes demonstrated the possibility of transferring photogenerated carriers from hematite to Prussian blue. This cell was characterized by incident photon-to-current efficiency (IPCE) and galvanostatic charge/discharge measurements under illumination and compared in darkness. A higher IPCE when potassium ions are employed in the cell was founded, which suggests an easy insertion/desertion of these ions inside/outside of the hexacyanometallate framework, related to the more compact water coordination sphere for this ion. The voltage cell increased when the system was charged under illumination, indicating an increase in the oxidation/reduction of iron centers in the hexacyanometallate structure due to the increase of photogenerated carriers in hematite. The cell's specific capacity reaches around 12% of the theoretical capacity, with a voltage close to the theoretical (1.5 V) and about 95% of coulombic efficiency when the cell was charged and discharged at longer times (8 h).

Author keywords

Charge/discharge

Photocell

Photoelectrochemistry

Prussian blue

α -Fe₂O₃ semiconductor