

Synthesis and Characterization of Mn₂V₂O₇ inverse opal structures for Photoelectrochemical Water Oxidation

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Photoelectrochemical (PEC) water splitting is one of the effective process to convert the abundant solar energy to Hydrogen chemical energy to meet upraising energy crisis. For scalability the process must be free from precious and toxic materials with significant efficiency to support the energy demand globally. We have prepared non-toxic and earth abundant manganese vanadate (Mn₂V₂O₇) inverse opal structures through self-assembled colloidal polystyrene (PS) spheres with a diameter of 200 nm for PEC water oxidation. The well controlled wall thickness of manganese vanadate with higher surface area provides enough light absorbance and efficient charge transport path. The photocurrent was evaluated under 1 sun illumination which showed a photocurrent of 0.2 mA/cm² at 1.23 V vs a reversible hydrogen electrode (RHE). The photocurrent onset found to be 0.2 VRHE with a TiO₂ passivation layer coated by Atomic Layer Deposition (ALD). The low photocurrent attributed to the electron-hole recombination loss originates from low electronic conductivity and charge separation efficiency.