Synthesis of $MnNiO_3/Mn_3O_4$ Nanocomposites for Water Electrolysis Process

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Abstract

Hydrothermal method was optimized to produce highly efficient, novel $MnNiO_3/Mn_3O_4$ nanocomposites for water electrolysis process. The predominant peak observed at 36.6° corresponds to the X-ray crystal plane orientation of (1-10) and confirmed Rhombohedral phase $MnNiO_3$ and other well resolved peaks attributed to the $MnNiO_3/Mn_3O_4$ nanocomposites. Vibrational properties and metal oxygen vibration present in Fourier transform infrared profile around ~570-620 cm^{-1}. The oxygen vacancies and electron trapping mechanism were revealed from photoluminescence spectra. The combined morphology of nanorods and distinguished nanopetals was achieved for highly active $MnNiO_3$ nanocatalyst. The band structure and modification was thoroughly studied by UV visible diffuse reflection spectroscopy and the observed band gap was 2.8 eV for $MnNiO_3/Mn_3O_4$ nanocomposites. Cyclic voltammogram and linear sweep voltammogram studies investigated the redox behaviour and water oxidation nature of the novel $MnNiO_3/Mn_3O_4$ nanocomposites. The excellent conductivity and ionic mobility were confirmed by electrochemical impedance spectroscopy. Long-time durability of 24 h stability test was carried out and reported for the optimized electrocatalyst. Hence, the present study completely dealt with the preparation of novel combination of $MnNiO_3/Mn_3O_4$ nanocomposites using controlled synthesis technique and the exploration of optimized candidate for efficient water electrolysis process.

Keywords: Novel $MnNiO_3/Mn_3O_4$, Nanorods-distinguished nanopetals, Water electrolysis process.