Abstract

Renewable resource of clean energy and the clean environment are fundamental requirements for life. To fulfill these requirements, we design the materials and modify synthetic methods to improve their electrocatalytic and photocatalytic activities. Three-dimensionally ordered macroporous 3DOM-LaCoO₃ perovskite, as an example, were prepared by using metal nitrate-L-lysine-citric acid precursor solution and colloidal crystal template. The high porosity of 3DOM framework is effective for the enhancement of the perovskite catalytic activity as illustrating by lower overpotential and high electrochemical surface area (ECSA). Cerium also plays a significant role in the maintenance of the 3DOM structure of 3DOM-La₁₋ₓCexCoO₃ and its content also affect to the electronic properties of the perovskite in oxygen evolution reaction (OER) activity. The boosted electrochemical surface areas and the enhanced activity of active sites due to cerium ion incorporated into the LaCoO₃ was responsible for the improvement of both OER/ORR performance. This strategy obviously manifest the new opportunity for designing the catalysts for energy storage and conversion application. We also developed 3DOM framework of cerium-doped titanium dioxide (Ce/TiO₂) as the photocatalysts for dye degradation. Polymethyl methacrylate (PMMA) and Pluronic 123 (P123) were used as the soft templates to assist the formation of hierarchical-Ce/TiO₂. The crystal structure, morphology and optical properties were studied by X-ray diffraction spectrometry (XRD), Scanning electron microscopy (SEM) and Ultraviolet-visible (UV-vis) spectroscopy, respectively. The specific surface area was determined by Brunauer-Emmett- Teller (BET) method. Their photocatalytic performance was evaluated in reactive red dye degradation. The results indicated that the 3DOM-Ce/TiO₂ powder showed superior photocatalytic reactivity compared to that of commercial TiO₂.