Preparation and characterization of $ZnO/ZnAl_2O_4$-mixed metal oxides for dye-sensitized photodetector using Zn/Al-layered double hydroxide as precursor

ABSTRACT

In this article, a simple new technique has been developed for the preparation of $ZnO/ZnAl_2O_4$-mixed metal oxide (MMO) as anode materials for visible light dye-sensitized (DS) photodetector using Zn/Al-layered double hydroxide (LDH) as precursor. Subsequently, a detailed correlation between the structural properties of the prepared samples and the photo-responsive behavior of the fabricated DS photodetectors was elucidated. Specifically, it is evidenced that a high surface area of the prepared mesoporous MMO anode materials exhibit excellent dye absorptivity and thus facilitate free electron transfer and increase the photocurrent in the fabricated DS photodetector. A significant bathochromic shift was observed in the optical energy of the prepared MMO samples under the increment of molar ratio, providing a short electron transfer pathway in the optimized Z7A DS photodetector, which in turn demonstrated photo-responsivity and photo-detectivity of 6 mA/W and $1.7 \times 10^{+10}$Jones, respectively. This work presents an alternative approach for the design of an eco-friendly MMO-based DS photodetector.

Keyword: Mixed metal oxide; Layered double hydroxide; Dye-sensitized photodetector; Photo-responsivity; Nanostructures