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Yuan-Chang Liang, Chein-Chung Wang

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Hydrothermally derived zinc sulfide sphere-decorated titanium dioxide flower-like composites and their enhanced ethanol gas-sensing performance

Yuan-Chang Liang* and Chein-Chung Wang

Institute of Materials Engineering, National Taiwan Ocean University, Keelung 20224, Taiwan

Email: yuanvictory@gmail.com (Y-C Liang*, corresponding author)

Abstract

Zinc sulfide (ZnS) sphere-decorated titanium dioxide (TiO_2) flowers at various ZnS hydrothermal synthesis durations were synthesized using a two-step facile hydrothermal methodology. The ZnS hydrothermal synthesis duration affected the content and distribution of ZnS spheres decorated on the surfaces of TiO_2 petals. Thus, the separate and random distribution of these spheres, without considerable aggregation, could be obtained by adequately controlling the ZnS hydrothermal synthesis duration. A structural analysis demonstrated that the as-synthesized ZnS spheres and TiO_2 flowers were in crystalline cubic zinc blend and rutile phases, respectively. Moreover, the gas-sensing response of the TiO_2 flowers to ethanol vapor markedly enhanced after the decoration of the ZnS spheres. An optimal ZnS hydrothermal synthesis duration of 2 h for the TiO_2–ZnS composites was determined to result in the highest gas-sensing response at the given gas-sensing test condition.