

Modification of anatase-rutile mixed-phase properties using Sn⁴⁺ doping for photocatalytic dye degradation

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The mixed anatase-rutile TiO₂ phase compositions have attracted widespread research interest due to their superior photocatalytic activity compared to their single-phase counterparts. TiO₂ properties can be improved by incorporating a dopant in the microstructures. In this observation, doping with Sn⁴⁺ ions into the lattice of TiO₂ enables the phase transformation from anatase to rutile at a low temperature compared to the conventional annealing method studied in our previous work. Attention was paid to the structure, band-gap, morphology, and photocatalytic activity of the samples. The results revealed that the Sn⁴⁺ ions entered into the TiO₂ lattice by substituting the Ti⁴⁺ ions and dispersed evenly inside the matrix. The substitution triggered the lattice structure's distortion, which caused the phase transformation from anatase to rutile at a low temperature. The rutile phase increased with an increase in Sn mol %. The Sn doping leads to the bandgap's narrowing and dramatically improves the photocatalytic activity in the visible light region. Therefore, the near-contact phase junctions have been created between anatase and rutile, accounting for the effective charge separations. The mixed-phase prepared by Sn-doping shows high photoactivity in the during the oxidation of MB dye relative to the undoped TiO₂. Although all Sn-TiO₂ showed some degree of activity in the photocatalytic reaction, these results shows that 3.5 mol % had the highest D%. The study provides a new route for synthesizing mixed-phase TiO₂ catalysts for photocatalytic applications and advances the understanding of the enhanced photocatalytic properties of anatase-rutile mixtures. Furthermore, substitutional Sn⁴⁺ doping showed significant improvement in UV photocatalysis as well as allowing for visible light activation of the catalyst.

Biography

D.K Muthee is a 27 year Old Kenyan PhD student at the University the Free State- S.A in physics department. She is a research assist at University of the free state. She published two articles during her masters and has three more under review in reputable journals.

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