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Synthesis of N-doped Potassium Tantalate Perovskite Material for Environmental Applications

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Abstract

Nitrogen containing potassium tantalate perovskite material has been synthesized by the solvothermal method using urea ($\text{CH}_4\text{N}_2\text{O}$) as a nitrogen source. The as-prepared sample was characterized by X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FT-IR), diffuse reflectance spectroscopy (DRS), scanning electron microscope (SEM), and energy-dispersive X-ray spectroscopy (EDX) and X-ray photoelectron spectroscopy (XPS). The particle size of nitrogen containing KTaO_3 observed from SEM images was found to be 100-150 nm. Doping KTaO_3 with nitrogen causes reduction of band gap from 3.5 to 2.54 eV. The incorporation of Nitrogen into the crystal lattice of KTaO_3 not only extended the absorption of light from UV (ultraviolet) region to visible region and also enhanced the photocatalytic activity. As prepared nitrogen containing KTaO_3 samples exhibit cubic-like morphology and noticed efficient photocatalytic activity towards methylene blue dye degradation under visible light illumination. The intermediates formed during photodegradation were identified by mass spectrometry (GC-MS) and proposed suitable degradation pathway.

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