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Enhanced Photocatalytic Performance of Titanium Dioxide-Carbon Composite Coatings Embedded with Silver Nanoparticles

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In the quest for efficient solutions for environmental remediation, titanium dioxide-carbon (TiO2-C) composite coatings with silver have emerged as promising candidates due to their nanostructural, morphological, and photocatalytic properties under visible light irradiation[1]. This study investigates the synthesis, characterization, and photocatalytic performance of these coatings, produced using the sol-gel technique followed by heat treatment at 500°C for 30 minutes. The uniform application of the coatings onto a glass substrate was confirmed through scanning electron microscopy (SEM) analysis, which demonstrated a homogeneous dispersion of the metal across the expanded graphite surface.

The integration of silver into the coatings, achieved through immersion in a silver nitrate solution and subsequent exposure to ultraviolet (UV) light, resulted in a significant enhancement of photocatalytic activity [2]. Photocatalysis curves showed up to 80% degradation of methyl orange dye under visible light irradiation over a period of six hours, with substantial degradation observed within the first two hours. This rapid degradation kinetics underscores the practical potential of these coatings in wastewater treatment and environmental remediation processes [3].

The characterization techniques employed, including X-ray diffraction (XRD), Fourier-transform infrared spectroscopy (FTIR), and Raman spectroscopy, provided insights into the crystal structure, chemical composition, and functional groups present in the coatings. The results indicate the successful incorporation of silver into the TiO2-C matrix, which may lead to the formation of silver nanoparticles or silver oxide species, known for their photocatalytic properties [4].

In conclusion, the comprehensive analysis of the TiO2-C composite coatings embedded with silver suggests their potential as efficient photocatalysts for environmental remediation applications. The homogeneous dispersion of silver within the coatings, combined with their well-defined nanostructural features and morphological traits, contributes to their enhanced photocatalytic performance under visible light irradiation. Future research could focus on optimizing the synthesis parameters to improve photocatalytic efficiency and exploring other potential applications of these coatings in areas such as solar energy conversion and antibacterial materials [5].

References:

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