Synergistic Effects in Photocatalytic Ammonia Synthesis Using Fe2O3-TiO2 Nanostructures

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Palavra chave: Photocatalysis, ammonia synthesis, Fe2O3-TiO2, nitrogen reduction, nanostructured catalysts.

Resumo:
The growing need for sustainable ammonia production has driven research into alternative synthesis routes that reduce environmental impact. This study investigates the photocatalytic reduction of nitrogen (N2) in the presence of water using nanostructured Fe2O3-TiO2 catalysts. A series of Fe2O3-based materials with varying TiO2 content (0.5%–50%) were synthesized and characterized. Surface area analysis (BET) indicated a significant increase in specific surface area with TiO2 incorporation, particularly for Fe2O3-50% TiO2, which exhibited a surface area of 215.8 m2/g, suggesting enhanced catalytic potential. Elemental analysis (XRF) confirmed the expected compositions, ensuring reproducibility in synthesis. Photocatalytic tests revealed a synergistic effect between iron and titanium oxides, leading to an improved ammonia conversion rate compared to pure Fe2O3 and TiO2. The results highlight the potential of Fe2O3-TiO2 composites as promising catalysts for sustainable ammonia production, contributing to a greener alternative to the Haber-Bosch process.