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A Comprehensive Review on Synthesis Techniques of Nanocomposites for Visible Light-Active Semiconductors

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Abstract: *The photocatalysis of different semiconductors has been the focus of several investigations on the breakdown of harmful organic compounds in waste water. Due of its potential to address several contemporary environmental issues, including pollution of the air and water, it has garnered significant interest in modern research. Because of their great photosensitivity, stability, and lack of toxicity, nano composite metal oxides, which make up the majority of typical light catalysts, are well-known for their efficacy in degrading a variety of environmental pollutants. Different methods exist for synthesising nanomaterials, including: both top-down and bottom-up methods. The optimal method is called the "top-down approach," which involves cutting a bulk material piece by piece until nanoparticles are obtained. Controlling the size, shape, distribution, composition, and degree of aggregation of the particles is of importance to these applications. The use of certain nanoparticles for photocatalytic applications is limited by their huge band-gaps, which cause a high rate of photogenerated electron-hole pair recombination. In recent times, noteworthy efforts have been undertaken to create novel or altered semiconductor photocatalysts that can use visible light (λ = 400 nm-700 nm). These endeavours include semiconductor coupling, metal ion doping, nonmetallic element doping, and organic dye sensitisation. Numerous studies have shown that coupling two semiconductor nanoparticles with differing band gap widths is one of the best strategies to lower electron-hole pair recombination and, as a result, increase photocatalytic activity. In addition, the ternary nano composites exhibit significant photocatalytic activity in visible light and effectively degrade organic dyes, suggesting a greater level of photocatalytic activity.*

Keywords: Coupling, Doping, Nanocomposite, Photocatalyst.

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