

Light tuning of the catalytic activity of decorated TiO₂: versatility throughout the UV-Vis spectrum

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Visible-light-mediated photo-redox catalysis has emerged as a valuable concept in organic synthesis to induce selective transformations avoiding the undesired photodegradation of organic molecules under UV exposure. On the other hand, the efforts to prepare photo-responsive materials is a growing field in heterogeneous catalysis, where the combination of easy separation, minimal product contamination, and catalyst reusability are major assets that can be combined with the use of light, usually connected with milder reaction conditions. Titanium dioxide (TiO₂) is a well-known semiconductor and its use as a photocatalyst has been widely explored as an alternative heterogeneous photoredox catalyst. The main disadvantage of the use of pure nanometric TiO₂ as a photocatalyst is the large band gap (> 3.1 eV) of this semiconductor that can only absorb UV light (<400 nm). Decorating TiO₂ with noble transition metals such as Pd, Au or Cu,¹⁻³ among others, can overcome this problem as the resulting materials usually absorb light in the visible region.

We present here our efforts to develop hybrid catalysts based on TiO₂ decorated with noble metal or metal oxide nanoparticles, which can be suitable catalysts for different organic transformation under mild conditions. We show that a hybrid photo-responsive material, can have different reactivity when irradiated with different light sources and thus, the preferred outcome can be tuned by the correct selection of wavelengths to which a single material is exposed.

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