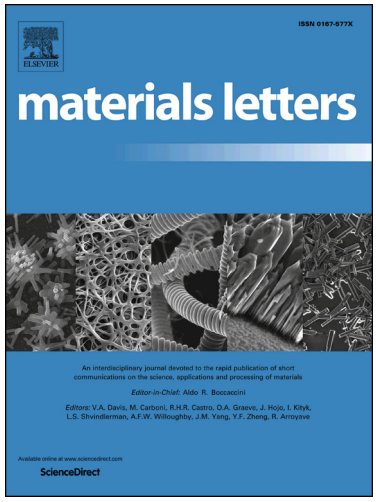

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Slow-photon enhancement of dye sensitized TiO_2 photocatalysis

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Photonic band gap engineered TiO_2 inverse opals were fabricated using self-assembled polystyrene films as sacrificial templates with controlled optical properties, aimed at the identification of the slow-photon effect on dye sensitized TiO_2 photocatalysis. The materials' photocatalytic efficiency was evaluated using Raman spectroscopy, on methylene blue photodegradation following both UVA and monochromatic visible light illumination. Contrary to UVA, where no photonic effect could be traced, laser irradiation within the slow-photon energy range of the TiO_2 inverse opals, resulted in a marked increase of the dye photosensitized degradation rate, outperforming not only compact nanocrystalline films but also the benchmark mesoporous Aeroxide® P25 TiO_2 films. This effect provides direct evidence for the presence of slow photons that amplify the interaction of visible light with the adsorbed dye molecules on the periodically structured TiO_2 film.

Keywords: Titanium dioxide; photonic crystals; photocatalysis; slow photons; Raman scattering; dye sensitization.