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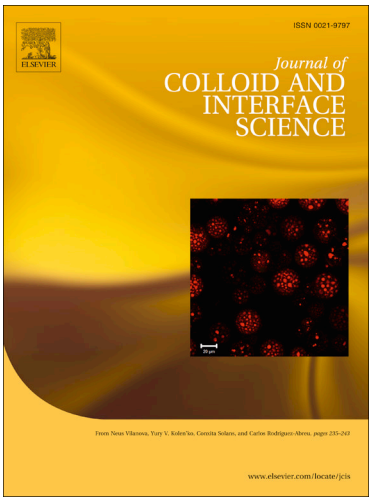

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Effect of phase composition on the photocatalytic activity of titanium dioxide obtained from Supercritical Antisolvent

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Abstract. Photocatalytic activity of TiO_2 nanoparticles is highly dependent on their phase composition. The coexistence of anatase and rutile phases in a single nanoparticle eases the electron transfer process between the phases, and favors the separation of photogenerated pairs. In this work, highly photoactive mixed-phase TiO_2 nanostructures were prepared by supercritical antisolvent precipitation (SAS), an environmentally friendly technology. It is shown here that this methodology has the remarkable ability to produce highly porous ($515 m^2/g$) and crystalline TiO_2 nanoparticles. The phase composition of as-prepared TiO_2 samples can be tailored through annealing process. Several mixed-phase TiO_2 samples were tested to assess the correlation between photocatalytic activity and phase composition. The photocatalytic performance is strongly affected by the anatase-rutile ratio, since the synergism between phases enhances the charge separation, reducing the recombination effect of the photogenerated pairs (e^-/h^+). It was found that the nanocatalyst composed by 7.0 wt% of rutile phase and 93.0 wt% of anatase phase, named as TiO_2_650, presented the highest photodegradation for both methyl orange (MO) and methylene blue (MB) dyes. Interestingly, TiO_2 samples prepared by SAS have superior photoactivity than the benchmark photocatalyst names as P25, which is a widely used TiO_2 material composed of anatase and rutile phases.

Keywords: Supercritical CO_2 antisolvent, TiO_2, Anatase, Rutile, Photocatalysis.