

PREPARATION OF CORE-SHELL STRUCTURES BY COATING POLYSTYRENE MICROPARTICLES WITH NANOPARTICLES OF TiO₂ AND Fe₃O₄

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Polystyrene microparticles were coated with one, two and even three different shells of oxide nanoparticles. The coatings of two types of latex were compared. The first one consisted of sulfate-functionalized polystyrene (S-PS) particles of 1.0 μm , prepared by the procedure described in [1]. The second type of latex was made up of 2 μm polystyrene carboxy-functionalized (C-PS) particles. Both types of latex present a polydispersity index $PI < 0.05$, the particles are hydrophobic and the latexes are electrostatically stabilized. The density of the particles is $\rho_{\text{PS}} = 1.054 \text{ g/cm}^3$, the refractive index $n = 1.59$ and the surface charge density is $\sigma_{\text{S-PS}} = 9 \mu\text{C/cm}^2$ and $\sigma_{\text{C-PS}} = 15 \mu\text{C/cm}^2$.

Regarding the oxides, three different types of nanoparticles were synthesized: positive TiO₂ [2], negative TiO₂ [3-4] and positive Fe₃O₄ nanoparticles [5]. The size of the nanoparticles can be modified by controlling the time of reaction. While the charge of the TiO₂ nanoparticles depends of the pH, negative Fe₃O₄ particles could not be prepared, due to their small stability. The oxide nanoparticles were characterized by thermogravimetry, Transmission Electron Microscopy (TEM) and electrophoretic mobility experiments.

Single, double and triple coatings [6] were performed by alternating positive and negative shells of nanoparticles. The strength of the coatings was checked by removing the excess of nanoparticles and isolating the stable core-shell microstructures. This step was developed by centrifugalizing the dispersions and redispersing the coated particles into pure solvent. These core-shell structures were visualized by T.E.M.

References:

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Figures:

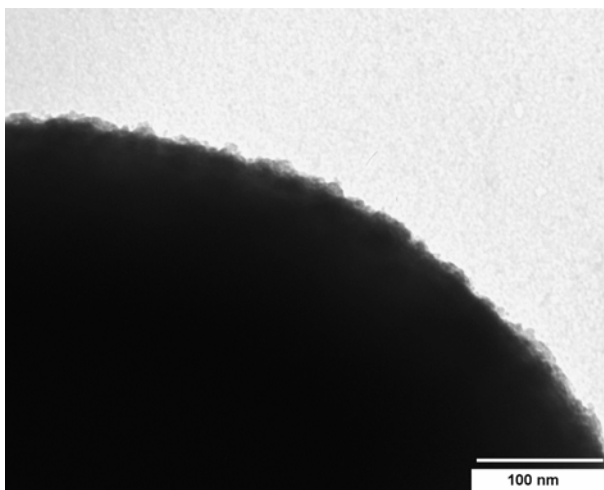
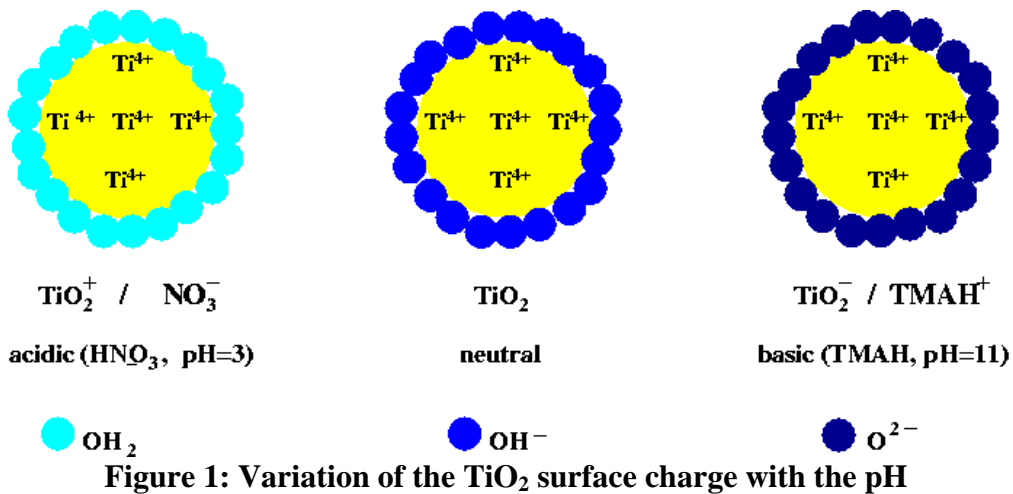


Figure 2: T.E.M. micrograph of a 1 μm polystyrene particle coated with TiO_4 nanoparticles

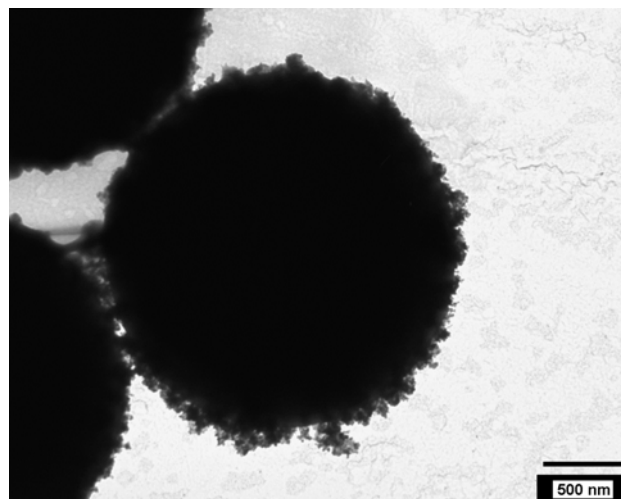


Figure 3: T.E.M. micrograph of a 2 μm polystyrene particle coated with 3 layers of TiO_2 , Fe_3O_4 and TiO_2 nanoparticles