

Macroporous foams obtained in highly concentrated Pickering emulsions stabilized solely with magnetic nanoparticles

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Macroporous solid foams with magnetic properties may have interesting applications as adsorbents for purification and decontamination processes. High pore volume can ensure a high degree of absorption, and magnetic properties can facilitate removal from environment. Organic macroporous polymeric foams, with high pore volume and high degree of interconnectivity, can be obtained by polymerizing in the external phase of highly concentrated emulsions, stabilized with surfactants [1-4]. In the present work, the main objective was to incorporate magnetic nanoparticles on the pore walls. Therefore, an alternative method for the preparation of solid foams was used [5], based on Pickering emulsions, which are stabilized solely with nanoparticles in absence of surfactant [6-7]. Oleic-modified magnetic nanoparticles were used to prepare highly concentrated water-in-oil (W/O) Pickering emulsions, in which the monomers are located in the external continuous phase. The degree of oleic acid modification was optimized to achieve the appropriate hydrophilic-lipophilic balance of the magnetic nanoparticles, in order to maximize emulsion stability. The resulting highly concentrated Pickering emulsions showed bigger droplet size and greater stability, compared to conventional highly concentrated emulsions. Porous materials were obtained by polymerizing the monomers using an oil soluble initiator. No time-consuming purification was needed, since the emulsions did not contain any surfactant. The results showed that the polystyrene monoliths had very low density and showed big macropores with relatively closed-cell pore morphology (Fig. 1a), typical for this kind of systems. The nanoparticles remained at the pore surface (Fig. 1b), and the monolithic solid foams retained the magnetic properties resulting from the nanoparticles.

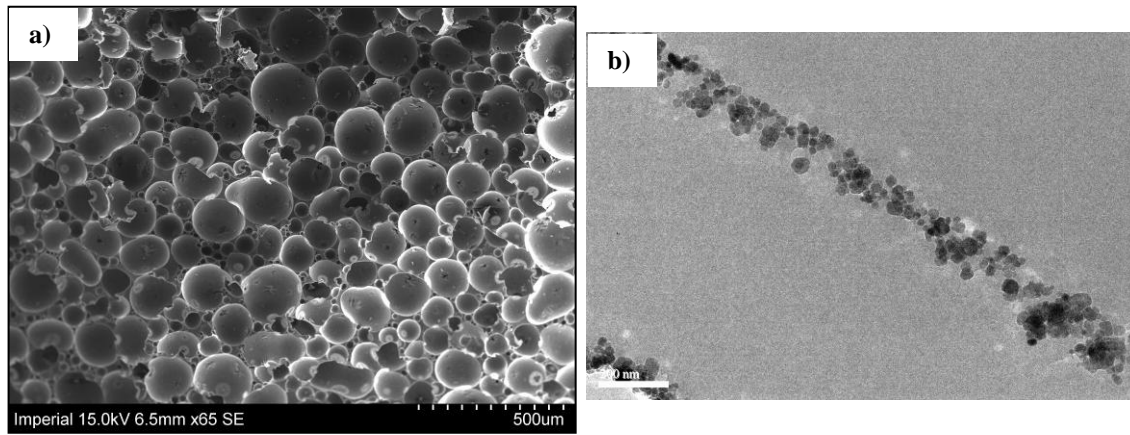
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Figure 1



a) SEM image of a polystyrene foam obtained in Pickering emulsions stabilized solely with 3wt% iron oxide nanoparticles (scale bar = 500 μm); b) TEM image of a slide (60 nm thick) showing the nanoparticles located at the polystyrene-air interface (scale bar = 200 nm).