Synthesis and Characterization of Porous Materials Prepared by Templating in Oil-in-Alcohol Highly Concentrated Emulsions

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Highly concentrated emulsions are an interesting class of emulsions characterized by an internal phase volume fraction exceeding 0.74, the critical value of the most compact arrangement of uniform, undistorted spherical droplets [1-3]. Consequently, their structure consists of deformed (polyhedrical) and/or polydisperse droplets separated by a thin film of continuous phase, a structure resembling gas-liquid foams [1-3].

In the present work, the main objective was to obtain porous materials with very high pore volume, by templating in highly concentrated emulsions. The porous materials were prepared by polymerizing in the external phase of highly concentrated emulsions, which consisted of hydrocarbon droplets dispersed in a furane derived alcohol (Oil-in-Alcohol highly concentrated emulsions). The emulsions were prepared by stepwise addition, with mechanical stirring, of the hydrocarbon (80 wt%) to the furane derived alcohol phase (20 wt%), which already contained a suitable emulsifier [4,5]. The droplet size of highly concentrated emulsions was studied by optical microscopy and by laser diffraction on emulsions diluted after preparation. The image obtained by optical microscopy of the highly concentrated emulsion of furane derived alcohol, with a particle size between 17 and 18 μm of diameter, is show in Fig. 1.

The polymerization reaction was carried out by the addition of small amounts of hydrochloric acid. The porous polymer monoliths were purified by soxhlet extraction for 48 hours. In order to confirm that polymerization had occurred the chemical composition of the materials was studied with an IR Spectroscopy (FTIR). Large monoliths could be obtained, and its internal structure was observed by SEM. Figure 2 shows the image of an example of the macroporous network of a polymer monolith, with pore sizes around 15 μm. It can be observed that the structure of the porous polymer material is similar to that of the highly concentrated emulsion, which acted as template.

References

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Figures

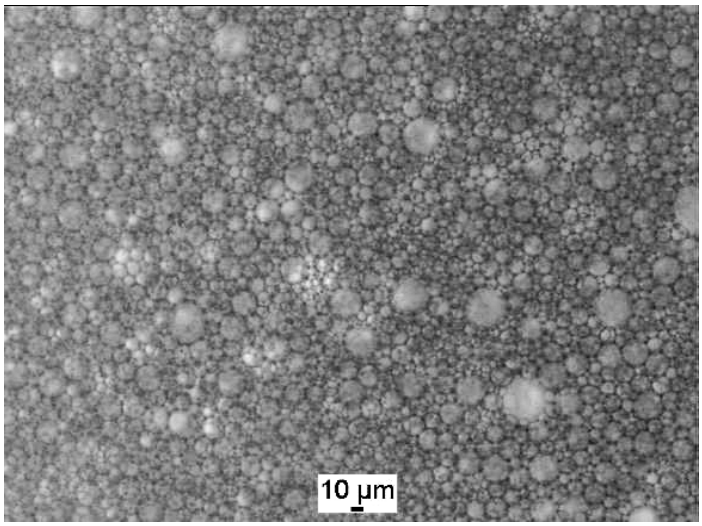
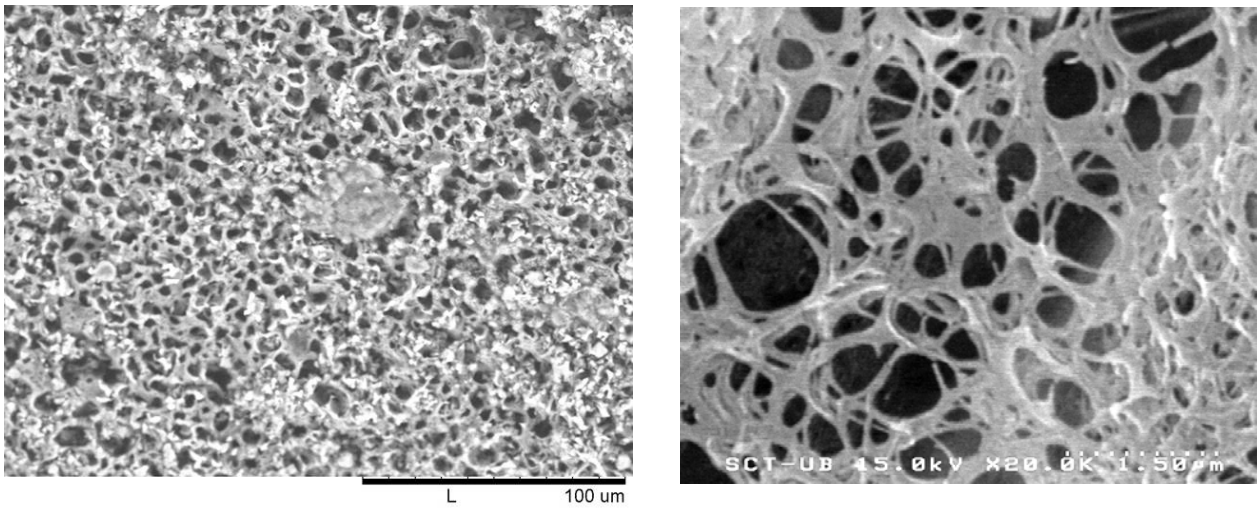


Fig. 1. Highly Concentrated Emulsion consisiting in hydrocarbon droplets dispersed in furane derived alcohol.



(a) (b)

Fig. 2. Polymer macroporous materials, as observed at low magnification (a) and high magnification (b).

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