

SMART CAPSULE-BASED SYSTEMS FOR SELF-HEALING MATERIALS VIA THE MINIEMULSION PROCESS

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ABSTRACT

The miniemulsion process is one the most versatile process for microencapsulation of hydrophobic [1-2] and hydrophilic liquid substances [3-4]. Miniemulsions are dispersions of small (30-500 nm) and narrowly distributed droplets in a liquid continuous phase. The coalescence and Ostwald ripening can be hindered and therefore droplets are usually used for performing organic, e.g. polymerizations [5], or inorganic reactions.

Miniemulsions can also be produced in non-aqueous conditions, either in apolar-in-polar [6] or polar-in-apolar [7] emulsion systems. This is particularly useful for encapsulating water-sensitive substances, such as isocyanates in reactions for self-healing materials.

Core-shell morphologies are obtained either by using the droplet interface as a template for a polymerization reaction (interfacial polymerization [3]) or by inducing a phase separation of polymer chains on the interface [4]. The phase separation can be induced by evaporation of a solvent and/or by a reaction (Figure 1). Capsule shells with controlled thickness were hence produced by radical polymerization, polyaddition techniques, or from premade polymers.

We present here several synthetic strategies for creating functional and stimuli-responsive nanocontainers for the release of monomers, which are used for self-healing reactions. It is shown that monomers and catalysts for Ring Opening Metathesis Polymerization can be successfully encapsulated and are kept active after encapsulation. The chemical functionality of the capsule surfaces is variable and therefore the capsules can be embedded in different substrates.

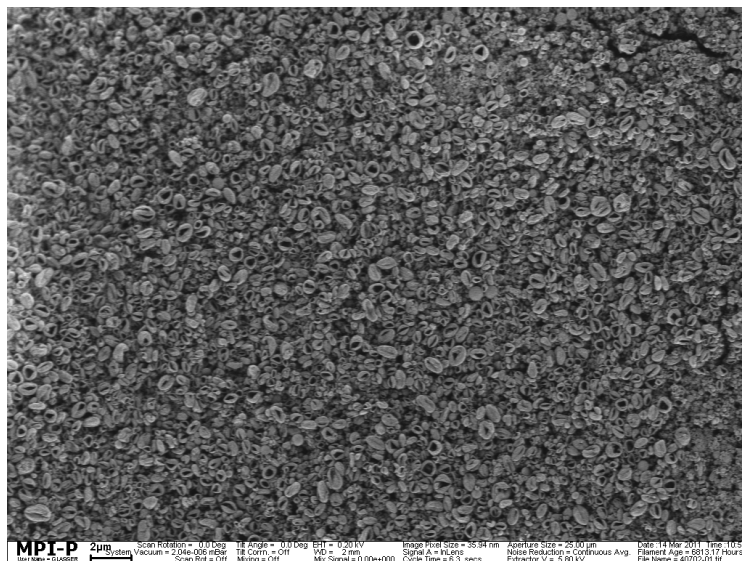


Figure 1: SEM micrograph of opened polycarbonate nanocapsules.

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