Formulation of surfactant-polymer systems for the synthesis of hybrid organic-inorganic nanocomposites

L-H. Guillemot [1], C.E. Hoppe [2], C. Rodriguez-Abreu [1]

1. Institut de Química Avançada de Catalunya. Consejo Superior de Investigaciones Científicas (IQAC- CSIC), Jordi Girona 18-26, 08034 Barcelona, Spain

2. Intema (Univ. Nacional de Mar del Plata - Conicet) – J. B. Justo 4302 - (7600) Buenos Aires, Argentina

craqci@iqac.csic.es

Nanocomposites consist of two or more segregated components incorporated in one material with characteristic lengths in the nanometer scale. They have attracted significant scientific and industrial interest due to their special optical, electronic, magnetic and chemical properties derived from the synergism between components. Applications such as detectors or optical waveguides in optoelectronics, among others, require the nanoparticles to be homogeneously dispersed in a polymeric matrix [1], leading to complex systems in which flocculation should be controlled.

In this work, bulk transparent, flocculation –free monolithic nanocomposites were synthesized by mixing a pre-synthesized colloid of surface-modified inorganic nanoparticles (NPs) with cross-linkable macromonomers, i.e. poly(dimethylsiloxane) (PDMS) containing reactive terminal groups (vinyl and hydroxyl). Nanoparticles dispersed in both organic and aqueous media were used; in the last case, an amphiphilic block copolymer (Polyoxyethylene grafted Polydimethylsiloxane, PEO-*g*-PDMS) was added to promote miscibility. To obtain such transparent monolithic nanocomposites, a phase behavior study was carried out at different temperatures on the crosslinkable mixtures to determine the regions of miscibility (see Fig.1).

It was also possible to obtain nanocomposites in the dispersed state by carrying out the crosslinking reaction using emulsions as templates to obtain microsized beads containing embedded nanoparticles (see Fig.2). Both bulk and particulate nanocomposites were characterized by several techniques such as spectrophotometry, microscopy, calorimetry and Small Angle X-ray Scattering (SAXS).

References:

[1] Pastoriza-Santos I., Pérez-Juste J., Kickelbick G., Liz-Marzán L., Journal of Nanoscience and Nanotechnology, **6** (2006) 1-6.

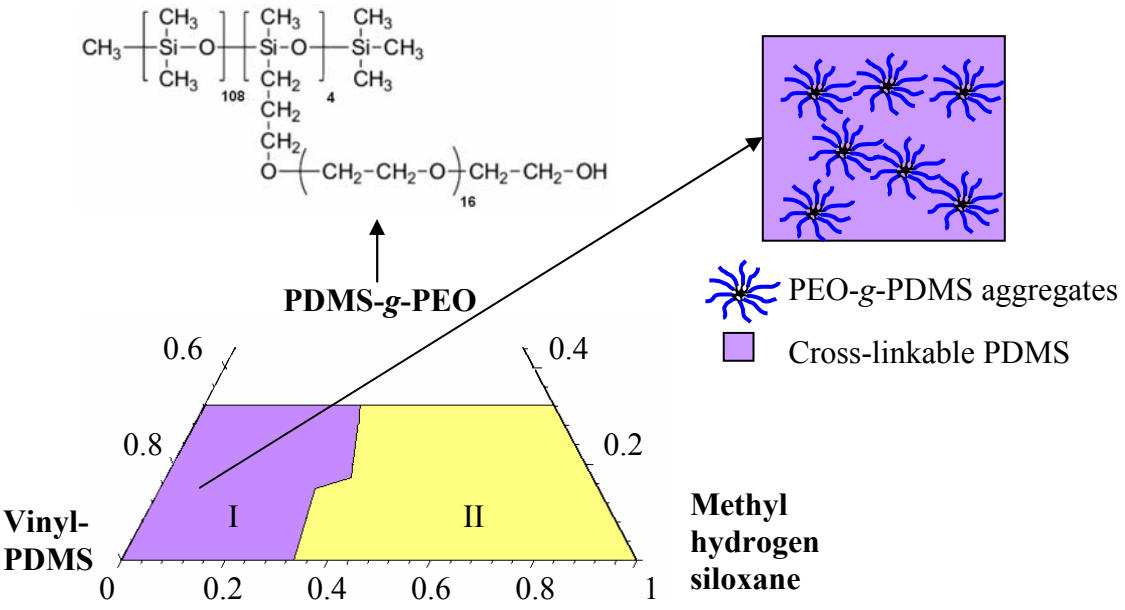

Figure 1: Partial ternary phase diagram of a Vinyl-PDMS/ PEO-*g*-PDMS/methyl hydrogen siloxane system at 50 ºC. I: transparent isotropic single phase region; II: turbid multiphase region.

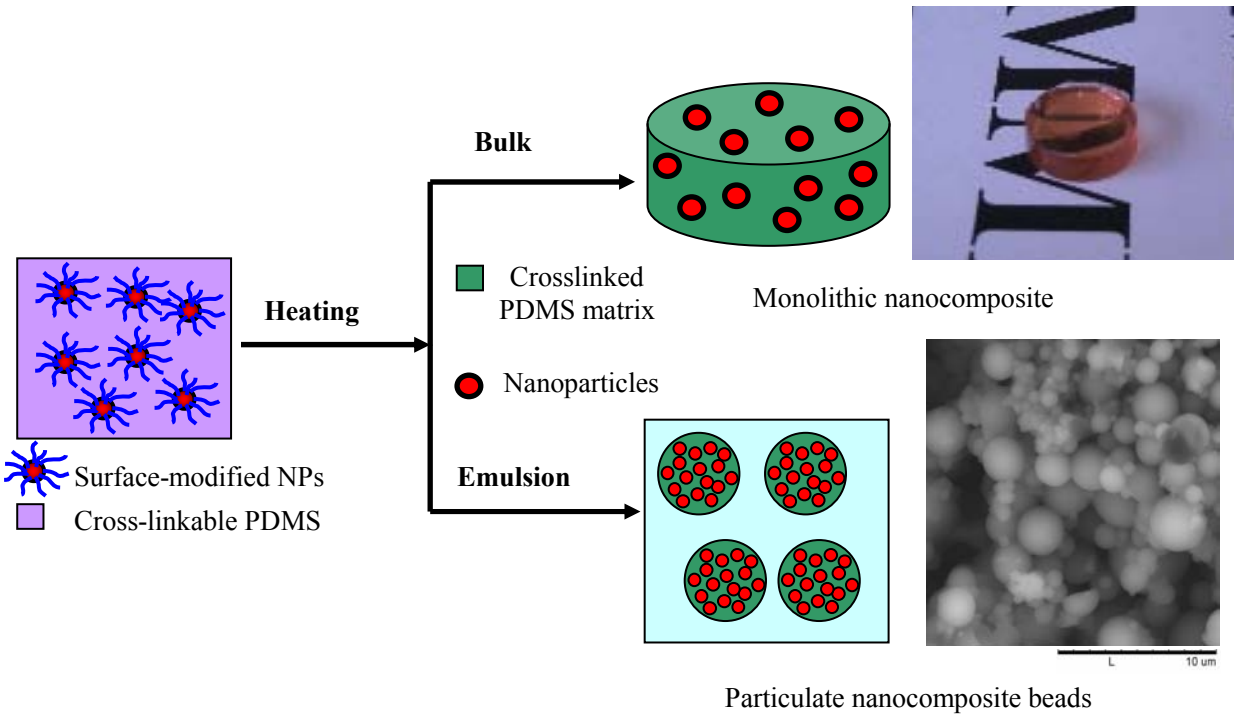

Figure 2: Schematic representation of the synthesis of nanocomposites in monolithic and particulate forms.