

SELF-ASSEMBLED FLUOROCARBON-SILICA NANOCOMPOSITES: STRUCTURE AND PROPERTIES

Carlos Rodríguez-Abreu,^{a)} Pablo M. Botta,^{b)} José Rivas^{b)}, Kenji Aramaki^{c)}, Manuel Arturo López Quintela^{d)}

a) Institut d'Investigacions Químiques i Ambientals de Barcelona. Consejo Superior de Investigaciones Científicas (IIQAB/CSIC), Jordi Girona, 18-26, 08034 Barcelona, Spain.

b) Departamento de Física Aplicada, Facultad de Física, Universidad de Santiago de Compostela, E-15782, Santiago de Compostela, Spain

c) Graduate School of Environment and Information Sciences, Yokohama National University, Tokiwadai 79-7, Hodogaya-ku, Yokohama 240-8501, Japan

d) Departamento de Química Física, Facultad de Química, Universidad de Santiago de Compostela, E-15782, Santiago de Compostela, Spain

craqui@iiqab.csic.es

Self-assembly is a “bottom-up”, low energy method used to prepare nanomaterials, usually assisted by amphiphilic compounds [1]. Among such compounds, fluorocarbon surfactants show special features which make them much more efficient than hydrocarbon surfactants in many applications. The functionalization of silica with fluorocarbon chains offers possibilities for applications such as protective coatings [2] and low dielectric constant materials for semiconductors [3]. We report on the properties of hybrid fluorocarbon-silica materials formed by the self-assembly of a fluorocarbon surfactant and aminoalkoxysilane coupling agents. The characterization was carried out by X-ray diffraction, Small angle X-ray scattering, Thermal Analysis, and NMR spectroscopy. The obtained materials have a structure consisting of alternated fluorinated and condensed silica nanosheets in a non-crystalline state. Time-resolved X-ray scattering measurements indicate that during the synthesis, the system undergoes a morphological transition from disordered aggregates (where the aminosilane acts as a reactive counterion) to the mentioned lamellar structure; this transition seems to be driven by a decrease in interfacial curvature induced by the hydrolysis and condensation of the aminosilane. The hybrid materials are hydrophobic and show a low dielectric constant (≈ 2.8), which is almost independent on frequency, as predicted by the Maxwell-Wagner model

References:

[1] M. Lazzari, C. Rodríguez, J. Rivas, M. A. López-Quintela, *J. Nanosci. Nanotechnol.*, **4** (2006) 892.

[2]. A. F. Thünemann, *Langmuir*, **2** (2000)824.

[3] G. J. A. A. Soler-Illia, P. Innocenzi, *Chem. Eur. J.*, **17** (2006) 4478.

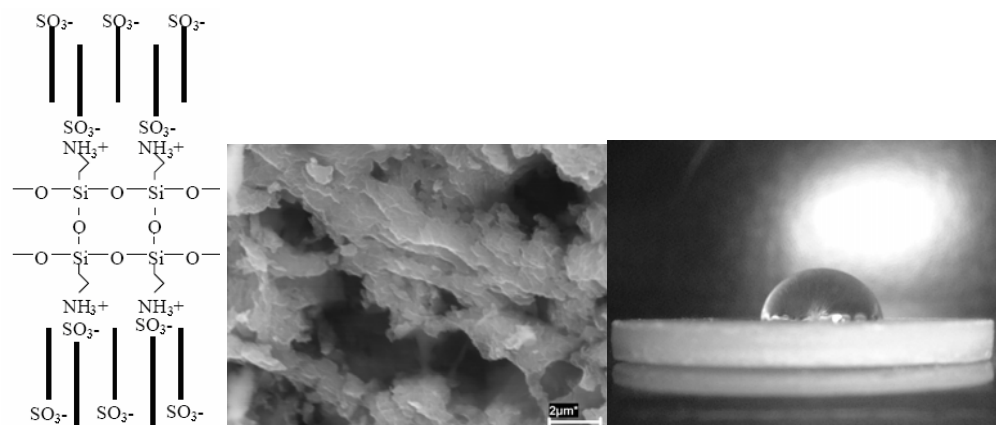


Fig. 1: Scheme of possible lamellar nanostructure in the hybrid material (left); SEM image showing a lamellar morphology (center); and photograph of a water droplet on a pellet of the material depicting the hydrophobicity of the surface(right).