IN-SITU SYNTHESIS OF NANOPARTICLES USING LYOTROPIC LIQUID CRYSTALS AS NANOREACTORS WITH DIFFERENT MORPHOLOGY

Carlos Rodríguez-Abreu[1], *Dharmesh Varade*[2]

[1]*Institut d`Investigacions Químiques i Ambientals de Barcelona (IIQAB/CSIC), Jordi Girona, 18-26, 08034*

[2]*Barcelona, Spain Graduate School of Environment and Information Sciences, Yokohama National University, Tokiwadai 79-7, Hodogaya-ku, Yokohama 240-8501, Japan*

craqci@iiqab.csic.es

Self-assembly of components by non-covalent interactions offers an invaluable tool for the preparation of nanostructures, with the advantage of being an spontaneous process with an inherent low consumption of energy[1]. Although much research has been done on the synthesis of nanoparticles using amphiphilic self-assembling systems, there is still a need of simple, scalable methods for producing three dimensional, ordered arrays of nanoparticles using this route.

Here, we present an study on the synthesis of silver nanoparticles using lyotropic liquid crystals with long range order formed in amphiphilic block copolymers in the presence of block selective solvents. Aqueous solutions of silver salts are solubilized and confined inside the reverse aggregates forming the liquid crystals, having aligned hydrophilic nuclei. The hydrophilic blocks of the copolymer act as reductants so there is no need to add reducing agents to produce metallic silver. Nanoparticle formation was followed by in situ UV-Vis spectroscopy , Small Angle-X-ray Scattering (SAXS), and Transmission Electron Microscopy (TEM), addressing the effect of different parameters such as temperature, salt concentration and liquid crystal morphology (micellar cubic or hexagonal). It was found that relatively uniform silver nanoparticles are formed and grow without disrupting the structure of the liquid crystalline host. Evidence on the presence of sub-nanometer atomic clusters was also found. Due to the high viscosity of the media, it is supposed that the collisions and diffusion of reactants between aggregates is much less than in previously studied systems, such as fluid microemulsions. Possible synthesis mechanisms and applications for material fabrication will also be discussed.

References:

[1] Lazzari, M. ; Rodríguez, C.; Rivas, J.; López-Quintela, A. J. Nanosci. Nanotechno., 6 (2006) 892.

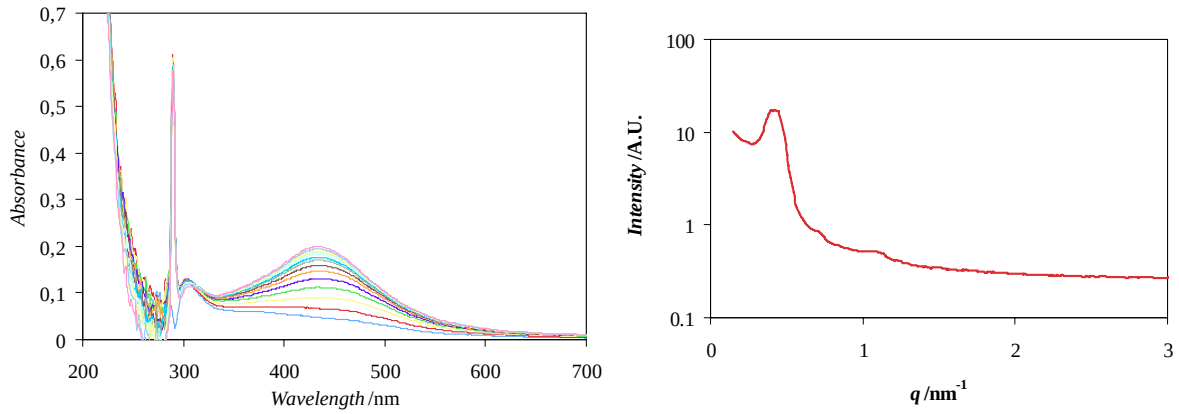

Fig.1 (Left) Time resolved UV spectra during nanoparticle formation inside a reverse micellar cubic liquid crystal (Right) SAXS spectra of the liquid crystal with embedded nanoparticles.