

## From the "Ouzo effect" to Nanocapsules

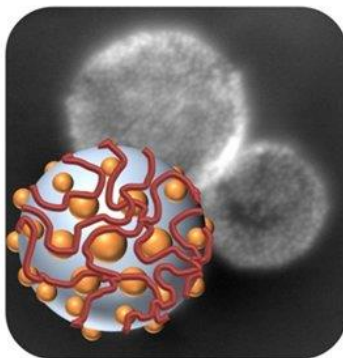
Fabienne GAUFFRE<sup>a\*</sup>, Soizic CHEVANCE<sup>a</sup>, Flavien SCIORTINO<sup>a</sup>, Clément GOUBAULT<sup>a</sup> Myrtil KAHN<sup>b</sup> and Marie-Bérengère TROADEC<sup>c</sup>

- a. Univ Rennes, CNRS, ISCR (Institut des Sciences Chimiques de Rennes)-UMR6226, F-35000 Rennes
  - b. Laboratoire de Chimie de Coordination UPR8241, CNRS, 205 rte de Narbonne, Toulouse Cedex 04
  - c. Univ Rennes, CNRS, IGDR (Institut des Sciences Chimiques de Rennes)-UMR6226, F-35000 Rennes
  - d.
- \* fabienne.gauffre@univ-rennes1.fr

**Abstract:** We report on a new method to generate hollow capsules with a hybrid shell made of nanoparticles and polymers, which were coined "hybridosomes". (Fig 1)[1]. The process is based on the formation of droplets in macroscopically miscible mixtures of organic solvent and water containing an hydrophobic solute, the so-called "ouzo effect". Our hypothesis is that nanoparticles stabilize such submicronic droplets by adsorbing at the liquid/liquid interface, similarly to Pickering emulsions. After addition of a crosslinking polymer and removal of the solvent core, hollow capsules of diameter ~100 nm are obtained. Nanocapsules were prepared from Quantum Dots, gold nanoparticles, superparamagnetic iron oxide nanoparticles and mixtures of different types of particles. The mechanical properties of the capsules were investigated using at the single hybridosome level via AFM nanoindentation as well as at the ensemble level using an osmotic pressure technique [2]. The entrapment of a fluorescent dye was also demonstrated. Thus, nanocapsules with dual properties (e.g. magnetic and fluorescent) are easily obtained. Interestingly, the magnetic/fluorescent nanocapsules enable Magnetic Resonance Imaging contrast enhancement of tumors *in vivo* and fluorescence imaging [1,2].

[1] F. Sciortino; G. Casterou; PA Eliat; MB Troadec; C; Gaillard; S. Chevance; M. L Kahn; F. Gauffre, Simple Engineering of Polymer-Nanoparticle Hybrid Nanocapsules ChemNanoMat 10.1002/cnma.201600155 (2016)

[2] F. Sciortino, M. Thivolle, M. Kahn, C. Gaillard, S. Chevance, F. Gauffre, Structure and Elasticity of Composite Nanoparticle/Polymer Nanoshells (hybridosome®), Soft Matter, DOI: 10.1039/C7SM00705A (2017)



**Figure 1 :** Schematic representation of hybridosomes made from QD and poly(acrylic acid) and SEM image