Fluorescent polymeric nanoparticles containing bodipy: synthesis, photophysical studies and application.

Gilles Clavier[1], Rachel Méallet-Renault[2], Chloé Grazon[1], Yang Si[1], Jutta Rieger[3]

[1] PPSM, ENS Cachan, CNRS, Université Paris-Saclay, 94235 Cachan, France

[2] Institut des Sciences Moléculaires d'Orsay (ISMO), CNRS, Université Paris-Sud, Université Paris-Saclay, F-91405 Orsay, France

[3] Sorbonne Universités, UPMC Univ Paris 06, CNRS, Institut Parisien de Chimie Moléculaire, Team : Chimie des Polymères, 4 Place Jussieu, F-75005 Paris, France

E-mail: gilles.clavier@ens-cachan.fr

Fluorescent nanoobjects have received increasing interest for their high potential in biology and biochemistry imaging. Recent works in controlled radical polymerization (CRP), allow the use of amphiphilic macromolecular RAFT agents and miniemulsion in order to both stabilise the nanoparticles and control the polymerisation of hydrophobic monomers.

Based on this methodology we developed a new strategy to prepare fluorescent nanoobjects where the fluorophore is copolymerised in the hydrophobic centre of the polymeric micelle. This approach afforded fluorescent nanoparticles of well-defined size, via a miniemulsion process in water based on a phase inversion, without the use of surfactants and hydrophobic cosolvent.[1] Using this methodology it was possible to obtain nanoparticles with increasing amounts of BODIPY fluorophores (from 500 to 5000 fluorophores per particle). Increasing the concentration of BODIPY lowered both the fluorescence quantum yield and the lifetime. However the brightness of the individual particles increases up to 8.10^7 (Figure 1). In order to understand the loss of fluorescence efficiency, fluorescence decays were recorded and fitted with a mathematical model using a stretched exponential function. This result gave an insight into the fluorophores arrangement within the hydrophobic core.[2]

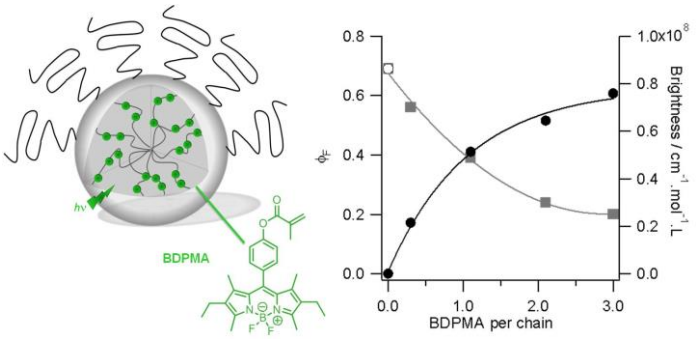

Figure 1. Schematic representation of the nanoparticles (left) and variation of fluorescence quantum yield and brightness of the nanoparticles as a function of the BODIPY concentration (right).

The presence of carboxylic acid functions in the hydrophobic shell allowed preparing fluorescein grafted nanoparticles that are pH sensitive. These nanoparticles could be used for the rapid and accurate detection of Escherichia coli growth.[3]

References: (Times New Roman 12)

[1] C. Grazon, J. Rieger, R. Méallet-Renault, G. Clavier, B. Charleux, *Macromol. Rapid Commun.*, **2011**, *32*, 699.

[2] C. Grazon, J. Rieger, B. Charleux, G. Clavier, R. Méallet-Renault, *J. Phys. Chem. C*, **2014**, *118*, 13945.

[3] Y. Si, C. Grazon, G. Clavier, J. Rieger, J.-F. Audibert, B. Sclavi, R. Méallet-Renault, *Biosens. Bioelectron.*, **2016**, *75*, *320*.