Wednesday, December 11th

Session: NANOPLASTICS & NANOCOMPOSITES

Givry – Savigny room

14h30 - 16h30

Keynote speaker: Eliane ESPUCHE

Nanocomposites routes for improved polymer function properties: synthesis and key-factors

Abstracts

The SFNano C'NANO joint meeting 2019

Thematic Session: (eg. Nanoplastics)
Keywords: (Nanoplastics, Characterization, Environmental fate, Impact)

Characterization and presence of nanoplastics in our environment

Julien Gigault[1], author 2[2], etc. (Calibri 11, Bold, black)

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The main objective of the research that I coordinate is to determine the life-cycle of micro- and nano-plastics (MNP) in the watershed area, to understand their fragmentation pattern and to investigate the first impact of the whole size distribution of plastics litter. In the sampling campaign in the North Atlantic Ocean - NOA (Expedition 7th Continent) realized in 2014 and 2015, we were the first to develop an analytical strategy for demonstrating the presence of nanoscale (colloidal) plastics mainly made of polyethylene in the NOA for the first time. Based on these unprecedented results, which help us to define a nanoplastic, several questions raise: What are the mechanisms of nano-plastics formation? Are the nanoplastics formed in the ocean or before in the watershed area? Where the other plastics at the micro and nanoscale are located? We found only PE and PS trace at the micro and nanoscale in the NOA. Where are the other polymers? Where do the Nano-plastics come from in the coastal zone? How reach the nanospeciation of the nanoplastics? Rapidly, based on recent expedition and missions, we identified the watershed area as the principal zone susceptible to play a key role in the MNP environmental fate and impact.
Through my presentation I will present you: (i) the analytical methodologies that we developed to identify, characterize and quantify nanoplastics in complex environmental matrices; (ii) the development of nanoplastics standards for analytical techniques and environmental studies in laboratory; (iii) the application of our methods to detect and quantify nanoplastics in soil, freshwaters, estuarine system (Mangrove swamp) and oceanic system; and finally (iv) the evaluation of nanoplastics behavior in environmental system by developing experimental set-ups taking account the dynamics of the natural features (salinity, UV light, temperature, etc.).

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Thematic Session: Nanoplastics & Nanocomposites
Keywords: Microplastics, Nanoplastics, Optical Tweezers, Raman Spectroscopy, Identification

Raman Tweezers for small microplastics and nanoplastics identification in seawater

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Abstract
Our understanding of the fate and distribution of micro- and nanoplastics in the marine environment is limited by the intrinsic difficulties of the techniques currently used for the detection, quantification, and chemical identification of small particles in liquid (light scattering, vibrational spectroscopies, and optical and electron microscopies). Here we introduce Raman Tweezers (RTs), namely optical tweezers combined with Raman spectroscopy, as an analytical tool for the study of micro- and nanoplastics in seawater. We show optical trapping and chemical identification of sub-20 µm plastics, down to the 50 nm range. Analysis at the single particle level allows us to unambiguously discriminate plastics from organic matter and mineral sediments, overcoming the capacities of standard Raman spectroscopy in liquid, intrinsically limited to ensemble measurements. Being a microscopy technique, RTs also permits one to assess the size and shapes of particles (beads, fragments, and fibers), with spatial resolution only limited by diffraction. Applications are shown on both model particles and naturally aged environmental samples, made of common plastic pollutants, including polyethylene, polypropylene, nylon, and polystyrene, also in the presence of a thin eco-corona. Coupled to suitable extraction and concentration protocols, RTs have the potential to strongly impact future research on micro and nanoplastics environmental pollution, and enable the understanding of the fragmentation processes on a multiscale level of aged polymers.

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R. Gillibert, G. Balakrishnan, Q. Deshoules, M. Tardivel, A. Magazzù, M. Donato, O. Marago, M. Lamy de la Chapelle, F. Colas, F. Lagarde, P. Gucciardi, *Environmental Science & Technology*, 53(13), 9003, 2019

The SFNano C'Nano joint meeting 2019

Thematic Session: Nanoplastics & Nanocomposites or Nanomaterials

Keywords: block polymer nanoparticles, self-assembly, fluorescent nanoparticles, mesoporous carbons, photopolymerization

Core-shell diblock copolymer nanoparticles prepared by visible light photopolymerization-induced self-assembly: Application in nanomaterials

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Abstract

Polymerization-induced self-assembly (PISA) has emerged as a standard methodology for producing well-defined block copolymer nanoparticles of various morphologies, ranging from conventional spheres to vesicles or fibers. However, PISA has been developed mostly using thermal radical initiators. Much less investigated is photo-induced PISA despite many distinctive advantages compared to the thermal method. We present herein an original photo-PISA process relying on a photo-mediated reversible addition–fragmentation chain-transfer (RAFT) mechanism, which proceeds at ambient temperature, under visible light, and without the need of any external initiator. A current issue in PISA has been to convert the nano-objects into useful materials. In this talk, three different nanomaterials are addressed: the design of robust dye-loaded fluorescent nanoparticles, the construction of mesoporous carbons based on colloid templating, and the formation of nanostructured coatings.

The SFNano C'NANO joint meeting 2019

Thematic Session: Nanoplastics & Nanocomposites

Keywords: polymer, nanocomposites, mechanical properties, microstructure

Overview of French research on microstructure-mechanical properties relationships in polymer nanocomposites

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Based on the reflections presented at the "convergence" days organized on December 10 and 11, 2018 by the INC (Institute of Chemistry) of the CNRS around the general theme of "microstructure-properties relationships in polymer materials", this presentation intends an inventory and a prospective of this major theme focusing more specifically on polymer-matrix nanocomposite materials. (the different presentations resulting from these days are available in French on the following link : https://inc.cnrs.fr/fr/cnrsinfo/action-convergence-structure-et-proprietes-dans-les-materiaux-polymeres).

After positioning the French community in the international context, a quick overview of the different French teams working on this theme will be given through some highlights from the last ten years. Far from being exhaustive, this review will allow to describe the current issues and problematics related to this type of material and will be organized around 4 main themes:

- Macroscopic behavior and applications (reinforcement, dissipation, fatigue, mechanical-physical properties coupling)
- Understanding of deformation mechanisms (in-situ deformation tests, instrumentation...).
- Interfaces (chain conformation and dynamics, link with macroscopic mechanical behavior).
- Durability (damage, rupture, effect of aging, bio-sourced and bio-inspired materials)

Finally, the future challenges facing the scientific community will be discussed considering, notably, societal and environmental issues, industrial requirements, fundamental understanding and modeling needs.