Contribution ID: **152** Type: **Talk (17 + 3 min)**

Integration of molecular machines and motors into supramolecular polymeric materials: structural properties studied by small-angle neutron scattering

Tuesday 21 March 2023 11:50 (20 minutes)

Switchable functional molecules capable of producing mechanical work constitute an active focus in nanotechnologies as they can be a source of components for molecular-based devices and materials. In particular, the dynamic nature of mechanically interlocked molecules allows their components to undergo relative internal movements, which can be exploited in translation and circumrotation. When it comes to using molecular machines to facilitate the creation of materials on the macro-scale, the primary concern is whether the nano-sized machines will be able to amplify their mechanical behavior to create a response in the bulk material. Hence, one of the most fundamental and challenging objectives associated to nano-machines rests on their coupling (in space and time) in order to transfer controlled motions from the molecular arena to the supramolecular and macroscopic scale. In the present work, we have developed two kinds of responsive contractile polymeric materials, which can behave as artificial muscles: i) The first one concerns nano-machines linked into a supramolecular polymer in which we produced micrometric motions (contraction/extension) by the integration of thousands of single contractile nano-switches by altering the pH of the solution; just like myofibrils do when packed in bundles in muscles. ii) The second one is based on the connection of light-driven rotary motors acting as reticulation units in an entangled polymer network. Small-angle neutron scattering (coupled with light and X-ray scattering) has been used to investigate the structure of the supramolecular self-assemblies of nano-machines before and after the induced structural changes as well as the dynamics of the contraction process at different length and time scales. We discuss here the relation between the local and overall structure of the selfassemblies and the properties of the materials. These findings open up new possibilities of using molecular machines in smart responsive materials.

Author: Prof. BUHLER, Eric (Université Paris Cité, laboratoire Matière et Systèmes Complexes)

Presenter: Prof. BUHLER, Eric (Université Paris Cité, laboratoire Matière et Systèmes Complexes)

Session Classification: From Polymers to Thermodynamics

Track Classification: Soft Condensed Matter