Séminaire

Mardi 17 février 2026 à 14h00

Amphithéâtre Henri Benoît

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In-situ Small-Angle X-ray Scattering and *operando* Phase-Contrast Tomography at synchrotrons to unveil 1) the fate of nanoplastics in biorelevant environments and 2) the design of bone scaffolds from nano-bio-glasses for regenerative biomaterials

This conference will address two current research topics for which we use synchrotron radiations to study the fate and interactions of nanoparticles in solution.

1) First, we will focus on the use of small angle X-ray scattering techniques (SAXS SWING@SOLEIL) applied to the smallest fragments of industrial plastics. We show how once released into the environment, these pose a serious ecological threat, particularly after interacting with biological molecules in biotic and abiotic environments.

2) The second part will present how these approaches can be used as well to study the essential mechanisms in the design of nanostructured biomaterials. A new-generation of synthetic bone scaffold is presented using a bricks-and-mortar approach from bioactive glass nanoparticles BGNps (SiO_2-CaO-P_2O_5 doped with metal ions, the bricks), and customized polymers (PLA, poly (lactic acid), the mortar). Used as synthetic implants for substitutive and regenerative therapies targeting mandibular osteoradionecrosis (ORM), they must promote bone formation and cell adhesion, while exhibiting high porosity, adequate mechanical strength, and pro-angiogenic coupled with antibacterial properties. Freeze-casting solutions of nanoparticles can result in hybrid nanocomposite scaffolds, with a multi-scale porosity, offering improved mechanical properties and proper auto-catalytic degradation.

To shed light on the mechanisms behind the formation of the hierarchical structure of these scaffolds, the synthesis of BGNps derived from Stöber silica was studied using *in-situ* SAXS at synchrotron facilities (ID02@ESRF and SWING@SOLEIL). The SAXS data revealed the preorganization of the particles in solution prior to freeze-casting. Subsequently, thanks to a custom-built sample chamber, fast X-ray phase-contrast tomography *operando* experiments were performed using synchrotron beams (ID19@ESRF). They allowed to follow the growth of centimeter-cubed scaffolds at high resolution and pictured the fabrication process from the initial suspension to the finalized porous material.

Les personnes souhaitant rencontrer G. Brotons sont priées de prendre contact avec Doru Constantin.