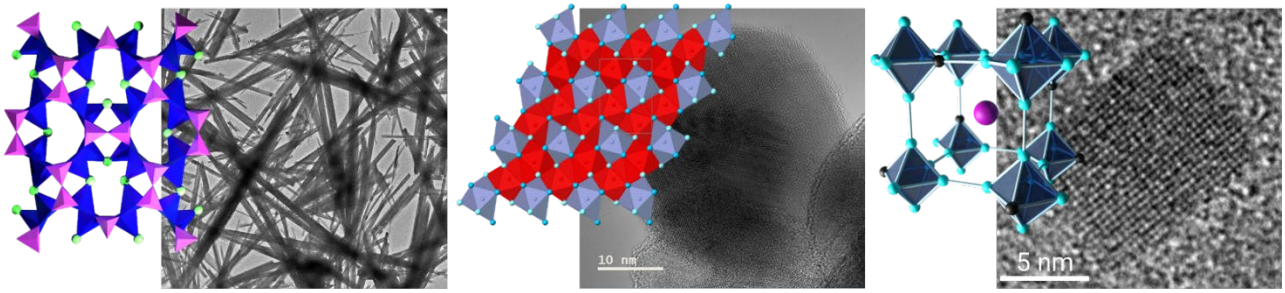
Synchrotron-based insights into the design of nanomaterials in molten salts: from synthesis to electrocatalysis

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Inorganic molten salts are non-volatile liquids stable at high temperatures, often up to 1000 °C. Performing chemical reactions in inorganic molten salts is a way to trigger reactivity in liquids at temperatures that usually pertain to solid-state reactions. This enables syntheses of unprecedented nano-objects: original oxychalcogenides,[1] III-V quantum dots,[2] and nanocrystals of original compounds[3] like borides[4,5] and silicides.[6–8] In most cases, these materials exhibit strong covalence that provides unique properties, from superhardness to (photo)(electro)catalysis for water splitting and CO_2 conversion to high-added value molecules. Nonetheless, reaction mechanisms at play in molten salts are mostly unknown, so that the key parameters enabling materials design remain to be discovered. Hence, it is increasingly important to shed light on crystallization pathways into inorganic molten salts and on the reactivity of the resulting materials.

In this talk, I will discuss how synchrotron radiation, especially *in situ* X-ray diffraction and scattering, X-ray absorption spectroscopy, and emission spectroscopy, can unveil complex crystallization pathways in molten salts. I will focus on the development of boride, carbide, silicide, and phosphide nano-objects, to discuss how one can tune reaction pathways in molten salts towards such original nano-objects. The presentation will address several questions: how to unveil reaction mechanisms in molten salts by using *in situ* synchrotron radiation-based spectroscopies?[7-9] How to trigger transformation of nanocrystals in molten salts?[8] How to design original and efficient electrocatalysts for water splitting and CO_2 conversion in high added-value molecules? Can we unveil the origin of the electrocatalytic performances of these materials by coupling *operando* spectroscopies[6,8] and calculations?[10]



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