

## **X-ray Nanotomography for Imaging Nanostructured Materials**

*Dr. Alessandro Sepe, Adolphe Merkle Institute, University of Fribourg*

Research on various biological and bio-inspired materials is essential in order to obtain a comprehensive insight into (i) the ultrastructural details of these structures and (ii) on how various processing conditions determine their final assembly. For this, we particularly focus on the structure-function relationship within these materials. The technique of choice is synchrotron scanning coherent diffraction nanotomography, in order to obtain ptychographic nanotomography reconstructions. This X-ray-based technique allows a full 3D insight into the materials and thus exploring, for instance, the molecular assembly occurring within the bio-inspired materials. Such insight allow us to shed light on the morphological properties that might lead to new generations of bio-inspired technologies or further extending the knowledge on the structure-function relationships within these materials. Biological structures, e.g. photonic structure encountered in numerous animals and plants, can then be used as a model for bio-inspired applications that aim at increasing their efficiency and usability, as well as accurately controlling their assembly pathways through the understanding of the key physical chemistry factors involved within the assembly process. Within our studies natural structures are used as model structures aiming at a deeper understanding on evolutionary optimized structures. Using X-ray nanotomography we are, for instance, able to visualize the three-dimensional chitin network within beetle scales that assembled naturally under ambient conditions. Further insight into this process will enable scientists to adapt assembly pathways from nature and envision novel applications. Our research aims at optimizing the nano-fabrication route of bio-inspired materials in order to achieve the desired morphologies for new generations of bio-technologies.