Monitoring bioinspired collagen mineralization through X-Ray Total Scattering

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Bone is an extremely complex tissue with many levels of organization.[1] The building blocks of such a complex architecture are the mineralized collagen fibrils.[1] Over the past years, notable advances have been made towards unveiling the role of the organic matrix (*i.e.*, collagen fibrils and non-collageneous proteins, NCPs) in driving mineral nucleation and growth. However, many aspects are still far to be understood. For instance, the mechanisms underlying the amorphous-to-apatite crystallization and clarifying the origin of platy apatite crystals has never been directly revealed in neither *in vivo* nor *in vitro* experiments. Remarkably, spherical amorphous calcium phosphate (ACP) precursors are found at the early stages, whereas apatite platelets are observed as the final crystalline product.[2]

Results from the *in situ* monitoring of collagen mineralization (under physiological conditions)[3] by synchrotron-based SAXS and WAXTS will be discussed. The great potential of Total Scattering methods (TS) for providing the stoichiometry, the structure as well as size and shape distributions of nano-apatites[4] will be also discussed.

Acknowledgments: This work has been carried out in the framework of the project BioBone (Andalucía Talent Hub, FP7-PEOPLE-2011-COFUND).

References

[1] W. Landis, R. Jacquet, *Calcif. Tissue Int.* **2013**, *93*, 329-337.

[2] a) Y. Wang, T. Azaïs et al., *Nat. Mater.* **2012**, *11*, 724-733; b) F. Nudelman, K. Pieterse et al., *Nat. Mater.* **2010**, *9*, 1004-1009.

[3] J. M. Delgado-López, F. Bertolotti et al., *Acta Biomater.* **2017**, *49*, 555-562.

[4] J. M. Delgado-López, R. Frison et al., *Adv. Funct. Mater.* **2014**, *24*, 1090-1099.