Poster Presentation

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Diffraction/Scattering Tomography on multi-phase crystalline/amorphous materials

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By suitably combining diffraction/scattering and tomography (DSCT), it is possible to access to selective submicron 2D/3D structural and micro-structural information, which cannot be obtained from separate, independent diffraction and tomography experiments. DSCT is used to discriminate between multi-phase crystalline and amorphous materials, especially when the similarities in densities limit the use of other methods. In addition, this method is sensitive to local variation of the crystalline state, texture, grain size or strains inside the object and can allow simultaneous 3D mappings of such properties. The DSCT phase-selectivity can be easily combined with fluorescence and absorption for added chemical and density resolution allowing multi-modal analyses. As samples can be used in their original state, this method can be applied without cutting or polishing them. Moreover the setup can be adapted with specific sample environments in order to monitor phase and microstructure evolution as a function of an externally controlled parameter with a non-invasive approach. After a first report on in 1998 [1], since 2008 capabilities of DSCT have been demonstrated using x-rays on complex materials as diverse as biological tissue, pigments, Portland cements, Carbon-based materials, Uranium-based nuclear fuel, Ni/Al2O3 catalysts or amorphous systems [2]. More recently, the technique has evolved towards quantitative characterization of the microstructure and stress/strain through either Rietveld or Peak Profile analyses and also pair distribution function techniques (PDF) and their application to nanostructured materials [3]. In this poster contribution, we briefly review the principle and methodology of pencil-beam based x-ray DSCT which is two-fold: (i) selective structural imaging and (ii) extraction of selective scattered patterns of ultra-minor phases.

[1] *Kleuker et al. (1998) Phys. Med. Biol.,43,2911-2923;,* ***[2]*** *Bleuet, P. et al. (2008). Nat. Mater. 7, 468–472; Stock, S. R. et al. (2008). J. Struct. Biol. 161, 144–150; Artioli, G., et al. (2010). Anal. Bioanal. Chem. 397, 2131–2136; Álvarez-Murga, M., Bleuet, P. & Hodeau, J.L, (2012) J. Appl. Cryst. 45, 1109-1124,* ***[3]*** *Álvarez-Murga, M. et al. (2012) Phys. Rev. Lett. 109, 025502; Palancher, H. et al. (2011) J. Appl. Cryst., 44,1111-1119; Jacques, S.D.M. et al., (2013) Nature Communications, 4, 2536.*

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