MS44-2-6 Advanced diffraction techniques on the PSICHE beamline, Synchrotron SOLEIL
#MS44-2-6

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Abstract
The PSICHE beamline of Synchrotron SOLEIL uses both imaging and diffraction to investigate materials, with a particular emphasis on in situ experiments under extreme conditions. To meet the particular requirements of these measurements, we have developed or implemented a range of advanced diffraction techniques. Here we will present a number of the most important developments: Combined Angle and Energy-dispersive Structural Analysis and Refinement (CAESAR) [1,2], Diffraction Contrast Tomography (DCT) [3], and recent developments to improve the reliability of residual strain measurements. The CAESAR technique is particularly suited to the study of amorphous or liquid samples at extreme conditions. We have optimised both the acquisition and data analysis strategies in order to minimise the acquisition time and obtain correctly normalised data. DCT and related approaches are used for study multi- or polycrystals. First experiments have focused on the onset of plastic deformation, while in future we hope to apply these techniques to phase transitions at extreme conditions. Finally, a recurrent problem in the materials science community is the difficulty of measuring residual elastic strain reliably in large-grained materials. We present a strategy inspired by the Friedel-pair approach used in DCT for minimising the pseudostrain problem.

References
1. Wang, Y., Uchida, T., Von Dreele, R., Rivers, M.L., Nishiyama, N., Funakoshi, K., Nozawa, A. and Kaneko, H. (2004). J. Appl. Cryst. 37, 947-956.
2. King, A., Guignot, N., Henry, L., Morard, G., Clark, A., Le Godec, Y., Itié, J.P. J. Appl. Cryst. 55(2): 218-227. (2022).
3. Ludwig, W., Reischig, P., King, A., Herbig, M., Lauridsen, E.M., Johnson, G., Marrow, T.J., Buffière, J.-Y. Rev. Sci. Instrum. 80, 033905 □2009□