Diffraction of Synchrotron Light for Material Chemistry

Dmitry Chernyshov

Swiss-Norwegian BeamLines at the European Synchrotron Radiation Facility (SNBL at ESRF),
Grenoble, France
dmitry.chernyshov@esrf.fr

Knowledge of atomic or molecular arrangement in solids (i.e. crystal structure) is of a fundamental importance for the material science. The advent of new radiation sources together with the development of detectors has facilitated many scattering tools probing structures at different spatial scales. Here we illustrate a variety of experimental options at a modern synchrotron source with relevant experiments done at BM01 line of SNBL at ESRF [1]. We show how *in-situ* powder diffraction of synchrotron light helps to rationalise chemical reactions [2], gas uptake and release by porous solids [3], and structural evolution of barocaloric materials. Surface sensitive scattering (grazing incidence diffraction) is exemplified by experiments with textured ferroelectrics and photovoltaic materials. Finally, we discuss single crystal experiments where synchrotron radiation helps to probe structural chirality [4], diffuse scattering [5], and domain structures [6].

[1] Dyadkin, V., Pattison, Ph., Dmitriev, V., Chernyshov, D., **2016**, *J. Synchrotron Rad.,* 23, 3
[2] Skjærvø, S.L., Ong, G.K., Grendal, O.G., Wells, K.H., van Beek, W., Ohara, K., Milliron, D.J., Tominaka, S., Grande, T., Einarsrud M.-A., **2021**, *Inorg. Chem.,* 11, 7632
[3] Dovgaliuk, I., Senkovska, I., Li, X., Dyadkin, V., Filinchuk, Y., Chernyshov, D., **2021**, *Angew. Chem. Int. Ed.*, 60, 5250
[4] Dyadkin ,V,. Prša, K., Grigoriev, S. V., White, J. S., Huang, P., Rønnow, H. M., Magrez, A., Dewhurst, C. D. and Chernyshov D., **2014** *Phys. Rev. B*, 89 140409
[5] Fuller, C. A., Quintero-Castro, D. L., Bosak, A., Dyadkin, V., Chernyshov, D. , **2022**, *Acta Cryst. B*, 78, 842
[6] Vakhrushev, S. B., Andronikova, D., Bronwald, Iu., Koroleva, E. Yu., Chernyshov, D., Filimonov, A. V., Udovenko, S. A., Rudskoy, A. I., Ishikawa, D., Baron, A. Q. R., Bosak, A., Leontiev, I. N., Tagantsev, A.K., **2021**, *Phys. Rev. B*, 103, 214108