

# 3D characterization of crystalline and magnetic structures using Neutron and X-ray imaging

Søren Schmidt<sup>1</sup>,

<sup>1</sup> Department of Physics, Technical University of Denmark

The 3DXRD (Three Dimensional X-ray Diffraction) methodology [1] for non-destructive characterization of individual grains in polycrystalline materials at the micrometer length scale has been around for almost two decades. Although initially motivated by materials science, especially within metallurgy, a wide range of other fields such as geology, structural biology and chemistry, have benefitted from this technique. Recently, a complementary technique, 3DND (3D Neutron Diffraction) [2], for imaging crystalline structures with time-of-flight neutrons has been achieved using the single crystal diffractometer SENJU at J-PARC combined with an imaging detector. Moreover, with the availability of the polarimetric setup at the new imaging beamline RADEN at J-PARC a novel technique 3DPNT (3D Polarized Neutron Tomography) [3] for measuring 3D magnetic fields in the interior of materials has been established. The talk will give an overview of the current state of the 3DXRD, 3DND and 3DPNT methodologies along with applications.

## References:

[1] *H.F. Poulsen, S.F. Nielsen, E.M. Lauridsen, S. Schmidt, R.M. Suter, U. Lienert, L. Margulies, T. Lorentzen, D. Juul Jensen*, Three-dimensional maps of grain boundaries and the stress state of individual grains in polycrystals and powders. *J. Appl. Cryst.* (2001) **34**, 751-756.

[2] *A. Cereser, M. Strobl, S. Hall, A. Steuwer, R. Kiyonagi, A. Tremsin, E.B. Knudsen, T. Shinohara, P. Willendrup, A. Bastos da Silva Fanta, S. Iyengar, P.M. Larsen, T. Hanashima, T. Moyoshi, P.M. Kadletz, P. Krooß, T. Niendorf, M. Sales, W.W. Schmahl, S. Schmidt*, Time-of-Flight Three Dimensional Neutron Diffraction in Transmission Mode for Mapping Crystal Grain Structures, *Sci. Rep* (2017), DOI:10.1038/s41598-017-09717-w.

[3] *M. Sales, M. Strobl, T. Shinohara, A. Tremsin, L.T. Kuhn, W. Lionheart, N. Desai, A.B. Dahl, S. Schmidt*, Three Dimensional Polarimetric Neutron Tomography of Magnetic Fields, *Sci Rep* (2018), *accepted*.