Texture analysis at the neutron strain diffractometer POLDI at PSI

Florencia Malamud*[1,2,3], Steve Gaudez[4], Ezequiel Fogliatto[4], Jan Capek[4], and Markus Strobl[4]

[1]Comisión Nacional de Energía Atómica, Laboratorio Argentino de Haces de Neutrones (LAHN) – Argentina
[2]CONICET – Argentina
[3]Paul Scherrer Institut – Switzerland
[4]Paul Scherrer Institut – Switzerland

Abstract

Neutron strain scanners have been proven to be a key tool for non-destructively determining the crystallographic texture at selected locations within a macroscopic object. In particular, time-of-flight (TOF) neutron strain scanners present the advantage that several crystalline reflections can be measured simultaneously for a given specimen direction, allowing the determination of several (incomplete) pole figures from a single experimental arrangement. Here we will present the implementation of a novel data analysis methodology to perform spatially resolved texture analyses in bulk specimens at POLDI, the Pulse Frame Overlap diffractometer at Paul Scherrer Institute. The method is based on the determination of several incomplete pole figures after splitting POLDI's diffraction detector, with angular range of 30○, into several units of smaller angular coverage. This is done by time-focussing the neutrons arriving at all the detection elements of the new 'virtual detector' into a single diffractogram, performing a 2D- least squares fitting of the diffraction data and creating experimental pole figures from the Euler angles of the explored sample orientations and the refined peak areas corrected by the flight path of the neutrons inside the sample. From the incomplete experimental pole figures, the determination of the orientation distribution function of crystallites is accomplished using MTEX toolbox. We will present demonstration experiments on additive manufacturing specimens and Zr-based components of nuclear power plants.

Keywords: POLDI, neutron diffraction, spatially, resolved texture analysis

*Speaker