Assessment of Orientation Dependence of Deformation Microstructures in Cold Rolled Duplex Steel: A Study Combining EBSD and Generalized Microstructure Pole Figures

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Abstract

The development of advanced materials, with optimum microstructural and mechanic properties, requires a detailed control of their microstructure, texture and crystalline defects. Different techniques can be used for the analysis of particular properties, but it is by their combination that a complete knowledge of their orientational development can be achieved.
In order to obtain a "global" characterization of the microstructure and texture, High Energy Synchrotron Radiation Diffraction can be employed because of line profile modification produced by accumulated defects. Different models have been developed allowing to quantify these defects, some of which require fitting either individual peaks or complete diffraction patterns. These techniques can be extended to texture measurements, often represented through orientation pole figures (PFs), and defect Generalized Pole Figures (GPFs) along different deformation stages.

On the other hand, for a more "local" characterization, Electron Backscatter Diffraction (EBSD) has proven to be extremely useful for microstructural and orientational analysis, allowing to assess defect accumulation in individual grains and orientations.
In this work, a set of 2205 duplex steel samples, cold-rolled up to 80% reduction, are studied, aiming to investigate the deformation evolution of defect storage in different orientations

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and texture components. For this purpose, Laue diffraction patterns have been obtained for these samples in P07 beamline in Petra III station (DESY), from which PFs and GPFs were obtained. This information is complemented with EBSD results, where dislocation arrays and grain and subgrain structures for particular orientations are studied. The combination of the mentioned techniques allowed for an exhaustive analysis of defect storage and microstructural orientation developed with increasing deformation.

Keywords: GPF, Synchrotron radiation, GND ODF, Grain Size ODF