# In-Grain Microstructure Evolution during Large Deformation of Multi-Phase steels

Karo Sedighiani*[1], Konstantina Traka[2], and Cornelis Bos[1,2]

[1]Tata Steel, RD, IJmuiden – Netherlands
[2]Department of Materials Science Engineering, Delft University of Technology, Delft – Netherlands

**Abstract**

We explore deformation heterogeneity and microstructure evolution during the cold rolling of multi-phase steels using high-resolution three-dimensional crystal plasticity simulations. Particular emphasis is placed on investigating the effect of initial uncertainties in material parameters and microstructures. A Fast Fourier Transform (FFT)-based spectral solver is used to conduct crystal plasticity simulations using a dislocation-density-based crystal plasticity model. The results are compared with experimental results obtained using electron backscatter diffraction (EBSD) experiments. Notably, we highlight the connection between the formation of in-grain and macroscopic shear bands and the uncertainties inherent in the initial microstructure. In addition, we discuss the evolution of in-grain orientation gradients, misorientation features, dislocation density, kernel average misorientation, and stress within major texture components. This thorough analysis enhances our understanding of the variation in microstructure evolution during the cold rolling of multi-phase steels.

**Keywords:** Crystal plasticity, Microtexture, Shear bands, Dislocation density, Polycrystalline materials

*Speaker