# Microstructural characterization and micromechanical modelling of internal lengths effects on the plastic behavior of ferritic steels

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Microstructural internal lengths play an important role on the local and macroscopic mechanical behaviors of steels. The dislocation density gradients near grain boundaries in a ferritic steel are investigated using SEM/EBSD together with instrumented nanoindentation [1] on the pre-deformed Al-k steels at 0%, 3%, 5%, 10% and 20% tensile strains. The effect of distances to grain boundaries on Geometrically Necessary Dislocations (GND) densities is, first, determined by analyzing orientation gradients from 2D-EBSD [2]. Then, nanohardness measurements are performed in the vicinity of grain boundaries. Data analyses show a clear correlation between the spatial gradients of GND density and the ones of nanohardness. Using a mechanistic model, the total dislocation densities are estimated from the measured nanohardness values. From both GND and total dislocation density profiles, the value of an internal length, denoted λ, is estimated from the analysis of dislocation density gradients near grain boundaries. This description of the internal length λ with plastic deformation due to GND hotspots near GBs extracted from both EBSD and nanohardness measurements is introduced in a micromechanical mean-field approach with internal lengths [3], in order to improve the description of the grain size dependent plastic behavior of Alk steels.

*Keywords: Internal lengths, Grain boundaries, Dislocation densities, Micromechanics, Steels.*

**References:**

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