

ANALYZING THE ONSET OF PLASTICITY IN FE-3WT.%SI

Nousha Kheradmand, Department of Machine Technique and Production, NTNU,
Nousha.kheradmand@ntnu.no
Stéphane Dumoulin, SINTEF Materials & Chemistry
Afrooz Barnoush, NTNU

Key Words: Plasticity, Fe-3wt.%Si, FEMCP, activated slip systems

Material microstructure plays an important role in the integrity and failure of structures. The complexity of the microstructure makes the investigating of its relationship to mechanical properties and failure difficult. Industrial products have complex structural and material designs, which make such investigation challenging. To overcome this, one may study at simpler systems and focus on e.g. single crystals made of simple model materials within a limited volume.

The current study aims at analyzing the onset of plasticity in single crystalline pillars of the model material Fe-3wt.%Si under compression.

Modeling of these microscale testing was performed using the finite element combined with crystal plasticity (CPFEM). Excellent agreement was shown between numerical and experimental results on the global response, i.e. load/stress versus displacement/strain curves. In addition, the local mechanical behavior was investigated in more details, i.e. whether the correct slip systems are active.

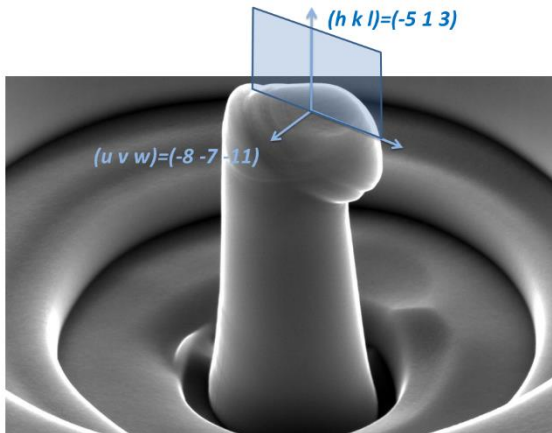


Figure 2 Single crystalline Fe-3wt.%Si pillar after deformation.

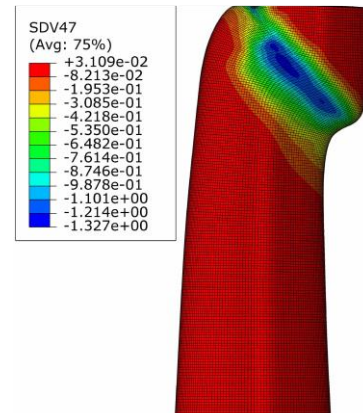


Figure 1 FEMCP of the same pillar in Fig 2. Activated slip system was similar to the experiments.