SM8L_11927

XXI International Congress of Theoretical and Applied Mechanics
Warsaw, Poland, August 15–21, 2004

# Stress Concentrations Caused by Dislocations at the Free Surface

**Steffen Brinckmann**, Erik Van der Giessen

*University of Groningen*

The key to understand fatigue lies in the understanding of fatigue crack initiation at the free surface. In turn, stress concentrations are essential to predict and comprehend the nucleation of the crack. Stress concentrations can arise from surface roughness, but also from dislocations in the bulk material. Persistent Slip Bands (PSBs) are found to be the primary structure of dislocations in fcc crystals. Brown and Ogin (1984) proposed a model which leads to logarithmic stress concentrations at the free surface. In this contribution edge dislocations are modeled as parallel line singularities which can move on multiple slip systems. We study a two-dimensional region next to the free surface in which plasticity is seen by dislocation movement. We compare the continuum solution of Brown with static and dynamic discrete dislocation simulations to show that his prediction of stress concentrations caused by PSBs at the free surface assumes a rather unphysical limiting situation.

View the extended summary