Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Large Scale Dislocation Dyniamics Simulation of Precipitation Hardening in Ni-based Superalloys RENGE LI, ZHIQIANG WANG — The precipitation hardening in Ni-based superalloys, which contain up to 73% volume fraction of γ', has been investigated by large scale 3D dislocation dynamics simulations. Dislocations glide under external stress across a {111} plane of γ/ γ' phase, intersected by cubic γ'precipitates. The critical resolved shear stress (CRSS) has been investigated for different microstructureal parameters: γ'volume fraction, anti-phase boundary (APB) energy and channel width. It is shown that the CRSS depends on the square root of the volume fraction of γ'. The CRSS is linearly proportional to the APB energy. Stuctures with a non-uniform distribution of γ'have CRSS that is 20%-30% smaller than a stucture with unique γ' size corresponding to the average size of the non-uniform disribution of γ'. The fact is that the channel width is not uniform and some channel width is larger than the average channel width of a stucture with a non-uniform distribution of γ', which makes the dislocation line easier to bend. This reveals that the channel width plays more important role than the γ' size. When channel width decreases to about 20nm, CRSS weakly depends on the γ'size and increases dramatically.

Renge Li

Date submitted: 19 Nov 2010 Electronic form version 1.4