EFFECT OF FINITE ELEMENT DISCRETIZATION ON TEXTURE PREDICTIONS USING MESOSCALE SIMULATIONS OF DEFORMATION AND RECRYSTALLIZATION*

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In recent years, detailed simulations of the deformation of metals at the mesoscale using the finite element method coupled with crystal plasticity have been used to gain greater insights into the evolution of texture and microstructure at the grain level. The effects of the level of detail in the finite element discretization used for such simulations are investigated by application of the mesoscale deformation model to bi-crystals and single crystals containing coarse, non-deformable particles. Regions in the vicinity of the grain boundary in the bi-crystal and around the hard particle in the single crystal form potential sites for the nucleation of recrystallized grains by virtue of the strong orientation and stored energy gradients that develop at these interfaces. Simulations of recrystallization texture involve the use of stored energy and orientation data obtained from the deformation model as inputs to a recrystallization model. The predictions of the recrystallization model are therefore tied to the ability of the deformation model to accurately capture deformation and orientation gradients in the mesoscale. By varying the mesh resolution near the grain boundary region of the bi-crystal or around the hard particle, an effort has been made to determine the influence of the discretization on the predictions of both the deformation and recrystallization textures in aluminum.