VISCOPLASTIC DUAL-PHASE STEELS MODELLING

E.A. Bonifaz, J.M. Martínez-Esnaola, A. Martín -Meizoso, J. Gil Sevillano
CEIT, Paseo de Manuel Lardizábal, 15, 20018 San Sebastián y Escuela Superior de Ingenieros,
Universidad de Navarra, Aptdo. 1674, 20080 San Sebastián - Spain

ABSTRACT

To predict the behaviour of dual-phase microstructures, a three dimensional (3D) viscoplastic-strain gradient finite element model has been developed. New expressions to represent the ferrite and martensite yield stresses are presented. The effects of grain size, rotation gradients, stretch gradients, strain rate and temperature on flow stress has been investigated. To describe the work hardening process in polycrystalline dual-phase steels, two models, a gradient-one-internal-variable model and a gradient-total dislocation density evolution model, constructed in the basis of the Kocks-Mecking model are proposed. Results demonstrate a strong dependence of flow stress on grain size, strain rate, temperature, finite element mesh and geometrically necessary dislocations expressions. The effect of plastic deformation gradients imposed by the microstructure are clearly observed.