Modeling of damage in ductile cast iron – The effect of including plasticity in the graphite nodules - DTU Orbit

In the present paper a micro-mechanical model for investigating the stress-strain relation of ductile cast iron subjected to simple loading conditions is presented. The model is based on a unit cell containing a single spherical graphite nodule embedded in a uniform ferritic matrix, under the assumption of infinitesimal strains and plane-stress conditions. Despite the latter being a limitation with respect to full 3D models, it allows a direct comparison with experimental investigations of damage evolution on the surface of ductile cast iron components, where the stress state is biaxial in nature. In contrast to previous works on the subject, the material behaviour in both matrix and nodule is assumed to be elasto-plastic, described by the classical J2-flow theory of plasticity, and damage evolution in the matrix is taken into account via Lemaitre’s isotropic model. The effects of residual stresses due to the cooling process during manufacturing are also considered. Numerical solutions are obtained using an in-house developed finite element code; proper comparison with literature in the field is given.

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