ID contributo: **189** Tipo: **Presentazione orale**

Evaluation of yield locus of SSFDI cast iron at high strain rate

giovedì 4 settembre 2025 15:30 (15 minuti)

Modern industrial applications require cast iron to operate ever closer to their mechanical limits thus cast irons with enhanced mechanical properties are required. Solid solution-strengthened ferritic ductile iron (SSFDI) proposes as a solution to this need, exhibiting superior thermomechanical properties compared to conventional ductile cast iron such as strength, hardness and toughness. Therefore, industries are strongly interested in exploring the SSFDI thermomechanical properties and defining numerical models capable of predicting their mechanical response, from plasticity to damage. Against this backdrop, the study investigated the elastoplastic response of SSFDI under quasi-static and dynamic loading conditions, evaluating the yield locus with tensile, compression, shear and torsion tests. The experimental test setup allows for local measures of the strain and temperature during the mechanical tests, simultaneously recording the sample with video and thermal cameras. The SSFDI exhibits a yield surface and hardening response dependent on the stress states coupled with compressible plasticity behaviour. Therefore, a compressible elastoplastic model was calibrated with an inverse finite element method aiming to predict the yield locus evolution in the function of strain rate and temperature

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Classifica Sessioni: Xtrema

Classificazione della track: High Strain Rates