

SUBMISSION IN BRIEF

Meeting: Materials Science & Technology 2012

Symposium: Failure Analysis and Prevention

Organizer(s): Larry Hanke; Tom Ackerson;

**Abstract Title:** Constructing a Validated Deformation Mechanisms Map Using Low Temperature Creep Strain Accommodation Processes for Nickel-Based Superalloy, Waspaloy.

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Presenter: Mahyar Asadi

**Abstract:** A creep Deformation Mechanism Map (DMM) of an engineering alloy can be an effective tool for developing physics based prognostics systems. Many classical diffusion based rate equations have been developed for time dependent plastic flow where dislocation glide, dislocation glide-plus-climb and vacancy diffusion driven grain boundary migration (diffusion creep) are rate controlling. Long term creep testing and analysis of complex engineering alloys has shown that power law breakdown phenomenon is related to the dominance of Grain Boundary Sliding (GBS) as opposed to diffusion creep. Rate equations are now available for GBS in complex alloys and, in this paper, a DMM is constructed for Waspaloy and validated by comparison with a collection of experimental data obtained from the literature. The GBS accommodated by wedge type cracking is considered dominant at low homologous temperatures (0.3 to 0.5T<sub>m</sub> - temperature in Kelvin) whereas GBS accommodated by power-law or cavitations creep dominates above 0.55T<sub>m</sub>.