



DAMAGE MECHANICS APPROACH TO DUCTILE FRACTURE AND LOW CYCLIC FATIGUE

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4:00 p.m. – 5:00 p.m.

Science Lecture Theatre S10

A damage mechanics approach is shown to be useful for the prediction of ductile fracture of the metal during plastic deformation and also of Low Cyclic Fatigue life. The approach can be applied in the general situation of under complex loading at elevated temperature where plastic deformations even at micro-level are involved. A damage criterion derived considers initiation and amalgamation of defects and fracture to be the accumulation of damage up to certain critical levels. The development of damage was observed to increase proportionally with the extent of accumulated plastic shear strain. The criterion is stress-path dependent where stress tensor influence is twofold: it either intensifies or suppresses defects development and in some cases stimulates their recovery. Strain based damage criterion seems in accordance to experimentally studied defects formed during plastic deformation. It is based on ductile properties of material, which will be discussed. This criterion can be applied to monotonic or cyclic deformation.

Dr. Rimma Lapovok graduated in Solid Mechanics from Ural State University and completed her PhD in Metal Working Processes at Ural Politechnical Institute (Russia). Her scientific interests include ultra-fine grained materials, modelling of non-isothermal plastic flow, constitutive behaviour of materials, and phenomenological theory of damage, with more than 80 publications on these topics. From 1998 she worked intensively in area of Severe Plastic Deformation, namely Equal Channel Angular Pressing. She designed ECAP machine initially for CSIRO and then for Monash University, that is unique in the world, providing unmatched precision and control for research on severe plastic deformation. In many projects on ECAP with back-pressure that she has supervised, the novel approach based on damage mechanics methods was applied.

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