

Damage Localization – a Precursor to Failure

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Abstract: This paper reviews the concept of damage localization and its application to time-independent (quasi-static) and time-dependent processes in heterogeneous materials.

For quasi-static process in a heterogeneous material with Weibull distribution, damage can be expressed by a function of state variable. Accordingly, the criterion for damage localization depends on Weibull modulus m . In particular, damage localization can appear even though stress gradient remains fixed and it is closely related to strain localization.

For time-dependent process, damage evolution law can be expressed by a function of stress and damage $f(\sigma, D)$. Accordingly, the criterion for damage localization can be expressed by $f_D > f/D$. Provided damage evolution law can be expressed by kinetics of microdamage, it is found that intrinsic Deborah number D^* plays a key role in damage localization. The criterion for damage localization has been applied to two extremes of time-dependent processes: spallation under wave loading and creep.

Keywords: damage localization, heterogeneity, intrinsic Deborah number