Behavior of porous material under dynamic conditions.

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The fracture of ductile materials is often the result of the nucleation, growth and coalescence of microscopic voids. In the present talk, we mainly focus on the growth process of voids. In dynamic loading, micro-voids sustain an extremely rapid expansion which generates strong acceleration of particles in the vicinity of cavities. These micro-inertia effects are thought to play an important role in the development of dynamic damage. To account for these large acceleration in the constitutive behavior, a multi-scale approach has been proposed in LEM3[1] and it has been shown that the micro inertia contribution to the macro stress is significant when dynamic loading is considered.

The presentation will exemplify micro-inertia effects by analyzing spall test in tantalum [2,3], crack propagation in dynamic loading [4]. In these two examples, an intrinsic length scale representative of the microstructure (size of the voids) is controlling the macroscopic response. This lengthscale was also shown to play an important role in the shock wave propagation. Indeed Czarnota et al [7] have been able to determine the width of the shock front which is scaled by the lengthscale. Finally, the model was extended to account for non spherical shape of voids [5,6]. The talk will present some flow surfaces for spheroidal voids. Under specific loading, non conventional flow surfaces are obtained. This result has been confirmed by finite element calculations and can be explained by the strong contribution of inertia.

References

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