Abstract Submitted
for the MAR08 Meeting of
The American Physical Society

Do pores strengthen materials? – A pore size effect analysis CATALIN PICU, MOHAN NUGGEHALLY, MARK SHEPHARD, Rensselaer Polytechnic Institute — Pores with radius larger than several microns are known to reduce the yield and flow stress of ductile materials and to increase their toughness. In this work we discuss a new mechanism leading to an increase of the strength of a material by nanosized pores. We show that voids grow by the emission of dislocations. As the void radius is reduced, while their volume fraction is kept constant, the mean spacing between voids decreases and their number increases. This makes the concurrent dislocation nucleation from neighboring voids more difficult. The situation is equivalent to increasing the density of dislocation sources in the material. Furthermore, we show that the critical stress for dislocation nucleation form an isolated void also increases as the pore size is reduced. The analysis is performed using a computationally efficient adaptive atomistic-continuum method.

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Date submitted: 23 Nov 2007 Electronic form version 1.4