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Students' Annual Seminar

Maximum ductility: role of cavitation in amorphous solids

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Amorphous solids are ubiquitous in nature and mechanical properties of these materials are of immediate importance for their industrial applications. The materials, which break catastrophically with small deformation, are called brittle materials and those, which can sustain longer deformation before failure, are termed as ductile materials. There are many parameters, which determine whether a material will break under external loading in brittle or ductile manner. Two such parameters, which are of practical importance, are the size and geometric shape of the material. It is recently found that mechanical properties of a material at nanoscale can be completely different from their bulk counterpart. In general it is well known that a bulk brittle and quasi-ductile materials fail via formation and subsequent merging of cavities but a proper microscopic understanding of cavitation in these materials are still lacking. In this study we want to understand the mechanical response of a model glass forming liquids as a function of varying geometric aspect ratio and sample size. Our initial results suggest that for a given temperature and straining condition, the sample shows cavitation only when the aspect ratio reaches a critical value and below this aspect ratio the sample breaks by forming neck, which are reminiscent of ductile material. The critical aspect ratio seems to also depend on the straining rate for a given temperature. We feel that this observed transition from ductile like failure to cavity dominated brittle like failure, as a function of aspect ratio will be very useful in future to understand the role played by cavitation in deformation and subsequent failure mechanisms of these materials.

Thursday, May 18th 2017

4:30 PM (Tea/Coffee at 3:45 PM)

Seminar Hall, TCIS