The Southwest Mechanics Lecture Series

at

Texas A&M University

From Microstructures to Nanostructures: the Behavior of Materials at High Strain Rates

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Time: **3:00 pm**
Location: **Room 110 Civil Engineering Building**

Nanostructured materials have been found to exhibit extraordinarily high yield strengths. We investigate the compressive stress-strain behavior of three ultrafine grained (UFG) or nano-grained metals (bcc-iron, hcp-titanium and fcc-copper) over a wide range of strain rates from 10^{-4} s^{-1} up to 10^{+4} s^{-1}. A wide range of grain sizes (20μm to 80nm) is investigated in the case of *bcc*-iron. The mechanical behaviors studied include grain-size dependent strengthening, strain hardening, strain-rate sensitivity of the flow stress, and deformation mode. Grain-size dependent strengthening and reduced strain hardening are observed in the UFG-/nano-materials compared with their coarse-grained counterparts. Further, the strain-rate sensitivity of the flow stress depends strongly on grain size in UFG-/nano-Fe and UFG-Ti. Shear bands appear to be the dominant mode of plastic deformation for Fe with grain sizes less than 300 nm. The shear band width appears to be related to the grain size, and substantial plastic deformation is observed within the bands, with no indications of recrystallization. In contrast, adiabatic shear bands developed within coarse-grained α-Ti *result* in the development of nanocrystalline microstructures as a result of the extreme plastic deformations.

Biographical Sketch:

K.T. Ramesh received his doctorate from Brown University in 1987. After a short stint as a postdoctoral fellow at the University of California, San Diego, he joined the Department of Mechanical Engineering at Johns Hopkins in 1988. He is now Chair of the Department of Mechanical Engineering, and Director of the Center for Advanced Metallic and Ceramic Systems. His research interests are in nanostructured materials, high strain rate behavior and dynamic failure of materials, biomimetics, and active materials.