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Fracture in Amorphous Alloys

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Abstract The mechanical properties of amorphous alloys have proven both scientifically interesting and of potential practical interest, although the underlying deformation and fracture physics in them remain less firmly established as compared with crystalline alloys. In this presentation, I shall review the recent advances made in understanding both ductile and brittle fracture behaviors of metallic glasses. Mixed-mode fracture experiments coupled with detailed finite element simulations that are conducted identify the fracture criterion in a nominally ductile BMG will be described first. These results show that fracture in amorphous alloys is controlled by the attainment of a critical strain and that a stable crack grows inside a shear band at the notch root before reaching a critical length. The Argon and Salama model, which is based on meniscus instability phenomenon at the notch root, has been modified to rationalize the physics behind such a length scale. Fracture mechanism in brittle metallic glasses will be discussed next, before concluding.

Biographical sketch Upadrasta Ramamurty obtained his PhD from Brown University in 1994 under the supervision of Professor Subra Suresh. Subsequently, he worked as a Post-Doctoral Fellow at UC Santa Barbara and MIT, and as an Assistant Professor in the School of Mechanical Engineering, Nanyang Technological University, Singapore, before joining IISc in October 2000. His teaching and research interests are in the broad area of mechanical behavior of materials. His current research interests include deformation and fracture behavior of amorphous as well as crystalline alloys, additive manufacturing, and development and application of nanoindentation techniques. He has co-authored 200+ papers in peer reviewed international journals, and is an editor of Acta Materialia and Scripta Materialia. He is a Fellow of the Indian National Academy of Engineering, the Indian Academy of Sciences, the Indian National Academy of Sciences, and the World Academy of Sciences (TWAS). He is a recipient of the Scopus Young Scientist and National Metallurgist Day awards, Shanti Swarup Bhatnagar and TWAS prizes (Engineering Sciences category), and Swarnajayanthi and JC Bose National Fellowships.

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