National Institute of Technology Rourkela

Departmental Seminar

Seminar Title	: Temperature dependence of pressure sensitive flow in bulk metallic glass composites
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Venue	: M.Tech class room (MM 202E), MM Annex building
Date and Time	: 30 Oct 2024 (3:00 pm)
Abstract	: The constraint factor, C, defined as hardness, H, to the yield strength, σy, ratio, is an indirect measure of the pressure sensitivity in materials. Previous investigations determined that while C is less than 3 for crystalline materials, and remains invariant with change in temperature, it is greater than 3 for bulk metallic glasses (BMGs) and increases with increasing temperature, below their glass transition temperature, Tg. In this study, the variations in C for two BMG composites (BMGCs), which have an amorphous matrix and in situ precipitated crystalline β-Ti dendrites, which in one case transforms under stress to α”-Ti and deforms by slip in the other, as a function of temperature are examined and compared with that of a BMG. For this purpose, instrumented indentation tests, with a Berkovich tip, and uniaxial compression tests were performed to measure the H and σy, respectively, on all alloys and their constituents at temperatures in the range of 0.48Tg and 0.75Tg. σy and H of the BMGC with transforming dendrites (BMGC-T) increase and remain invariant with increasing temperature, respectively. Alternately, in BMG and the BMGC with non-transforming dendrites (BMGCNT), the same properties decrease with increasing temperature. BMGC-T has the highest C of ~4.93 whereas that of BMGC-NT and BMG are ~3.72 and ~3.28, respectively, at 0.48Tg. With increasing temperature, C of the BMG and BMGC-NT increases with temperature, but that of the BMGC-T decreases. The values of C and their variations as a function of temperature were explained by studying the variation of pressure sensitivity of the amorphous phase and concluding that the plastic flow in BMGCs under constrained conditions, such as indentation, is controlled by the flow resistance of the amorphous matrix whereas that in uniaxial compression, which is only partially constrained, is controlled by plasticity in both the dendrites and matrix.