Deformation and failure of Magnesium and its alloys: role of specimen size and strain rate

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The deformation and failure of materials is largely influenced by the length and time scales. The length scales could be either *intrinsic* to a given material (*e.g. internal microstructure*) or *extrinsic* (related to the specimen dimensions), while the time scales are associated primarily with the rate of deformation. Many of the currently available continuum descriptions fail to capture the deformation behaviour across these length and time scales, mainly due to lack detailed understanding of the deformation mechanisms at these two extreme cases. So the need of the hour is to design and conduct experiments that can give insights to understand the mechanical behaviour at different length and time scales.

In this presentation, I will discuss the results of micro and macro-pillar compression and dynamic mechanical testing experiments performed on Mg and Mg alloys. Mg alloys have potential applications in aerospace, automobile and defence industries because of their high specific strength and stiffness. However, owing to their low symmetry hexagonal close packed crystal structure, they exhibit myriad interactions of complex deformation mechanisms (*e.g. slip and twinning*) thus leading to deformation heterogeneity and plastic anisotropy. Further, the mechanics and mechanisms of deformation in these alloys are less understood particularly at small length scales and high strain rates. Therefore, we have conducted experiments at these two extreme conditions with an objective to understand the plastic flow and failure mechanisms. Our experimental findings on Mg single crystals reveal that, specimen size, orientation and initial dislocation density plays a significant role on the primary deformation mode, flow and failure behaviour. Further, results from high strain rate experiments on Mg alloys suggests that, samples deform by slip show significant rate sensitivity in strengths while those that deform primarily by twinning does not exhibit rate sensitivity.

Biography:

Dr. Eswar Prasad Korimilli is currently working as an Assistant Professor in the School of Engineering, Mahindra Ecole Centrale - Hyderabad. He has obtained his Masters and doctoral degrees from the Department of Materials Engineering Indian Institute of science, Bangalore. Subsequent to his PhD, he worked as a post-doctorate research fellow at the Department of Mechanical Engineering, The Johns Hopkins University - USA. He works in the broad area of Mechanical Behaviour of Materials with a focus to understand the deformation behaviour at small length scales and high strain rates. He has authored or co-authored 14 publications in highly reputed scientific journals and his work has been cited about 500 times by several researcher across the world.