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Single Twinning Event Induced by Nano-Indentation in Magnesium

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Nano indentation provides the opportunity to study single twinning events. In the present work, a Nano indenter equipped with spherical tips of various radii was employed to examine a range of magnesium alloys as well as a single crystal of pure Mg. Our objective is to correlate features of the load displacement curve with twinning events and to ascertain twin initiation and growth stresses as well as the general phenomenology of the twinning events. Samples prepared to a very high quality surface finish, using mechanical polishing displayed a yielding point on the load-penetration depth curve corresponding to departure from Hertzian contact. This corresponded to the appearance of basal slip lines on the sample surface. Pop-in events were then observed at higher loads and these were marked by the simultaneous appearance of twins, evident on the surface following unloading. Twin thickening during continued penetration and shrinkage during unloading were also detected. Crystal plasticity finite element modelling was employed to estimate the stress state prior to the appearance of twinning. This enables us to estimate the critical stress for twin initiation but there is still considerable uncertainty in the values the non-unique nature of the model predictions.

Biography:

Mohan Setty is a Senior Research Engineer at Institute for Frontier Materials, Deakin University, Australia. Mohan began his research career a decade ago, working on light metals and its alloys. His research interest is primarily in mechanical characterization of materials, which includes nano-scale characterization as well. Over the past decade he has carried out research related to microstructure, thermo-mechanical processing and mechanical properties of Strip cast steel, Carbon fibers, Titanium, Aluminum and Magnesium alloys.

His most recent work on nano-mechanical characterization includes: testing radial heterogeneity of PAN fibers, room temperature and high temperature testing of TiN thin films, precipitate distribution in Al alloys, quantifying individual phase properties of high entropy alloys etc.,