GRAIN-SCALE INVESTIGATION OF THE ANISOTROPY OF PLC-TYPE PLASTIC INSTABILITY

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Various aspects of Portevin Le-Chatelier (PLC) type plastic instability, particularly the influence of strain rate, temperature and precipitation on the phenomenon have been investigated. Such investigations give insights into the underlying governing mechanisms and provide the basis for developing mechanistic and numerical models for these mechanisms. One aspect that is yet to be understood is the influence of anisotropy on plastic instability. So far, experimental efforts aimed at understanding this influence have been focussed on the influence of sample orientation and texture. However, direct measurement of the response of single crystals during uniaxial testing is essential for accurate characterization of the influence of anisotropy. Yet, such an endeavour is largely limited by the difficulty of producing single crystals of technical alloys. Insight into the orientation dependence of plastic instability is thus achieved in this work with a combination of spherical nanoindentation of single grains of Mg AZ91 and local orientation image analysis of cross sections of the nanoindents. Our results indicate that the local stresses arising from the underlying mechanisms that govern plastic instability in this alloy are strongly orientation dependent. In this talk, we will highlight the origin of the orientation dependence and the influence of twinning, and discuss the implications for macroscopic deformation.