

# **INSIGHTS INTO THE DEFORMATION MECHANISMS OF *hcp* MATERIALS FROM A COMBINATION OF DIFFRACTION AND MICROMECHANICAL MODELING**

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An in-depth study has been made of the deformation mechanisms of a number of zirconium alloys using a combined approach of diffraction and numerical modeling techniques. Zirconium based alloys are widely used in the nuclear industries due to their combination of excellent mechanical properties with low neutron absorption. However, the results reported are directly applicable to other *hcp* metals. Both single phase and dual phase systems have been investigated.

Lattice strain development and texture changes when the material is subjected to either compression or tension, in three directions relative to a parent texture have been measured by neutron diffraction, with elasto-plastic self-consistent models and finite element models used to interpret experimental data. The parameters describing the deformation modes were obtained through simultaneous fitting of all the experimental flow curves and internal strain data.

Assessment of such large data sets has resulted in very high confidence in the material parameters derived and has demonstrated, for example, the importance of incorporating hardening effects arising due to interaction between different dislocation slip mechanisms.