Feature engineering-based approach for capturing fundamental deformation mechanisms of plasticity in β-Ti21S

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Surface based slip trace analysis provides statistical insights into the synergistic coupling between different mechanisms occurring at the meso and microscopic length scales during the deformation of polycrystalline metals. Advancements in microscopy related techniques such as accurate electron channelling contrast imaging (A-ECCI) [1] and high-resolution electron back scattered diffraction (HR-EBSD) [2] data has provided access to multi-length scale datasets that can be treated via feature engineering algorithms. In particular, the enhanced contrast and resolution offered by these methodologies enable the application of automated feature extraction algorithms to extract useful information about the slip system activity distribution [3,4] and distributions for angular variables engaged in slip-transfer at grain boundaries [5]. The present talk focusses on how this information can be combined with principal component analysis to differentiate slip-transfer regimes and to tune yield parameters used in full-field crystal plasticity models [4,5]. Such an approach is statistically relevant and versatile enough to account for strain fields measured by digital image correlation and surface topography obtained from optical profilometry or atomic force microscopy.

Keywords: Plasticity, Titanium alloys, micromechanical modeling, feature engineering

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