

Variant Selection and Pre-transformation Phase Reconstruction for Deformation-Induced Transformation in AISI 304 Austenitic Stainless Steel

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Abstract : Austenitic stainless steels are widely used and give a good combination of properties. When this steel is plastically deformed, a phase transformation of the metastable Face Centred Cubic Austenite to the stable Body Centred Cubic (α') or to the Hexagonal close packed (ϵ) martensite may occur, leading to the enhancement in the mechanical properties like strength. The work was based on variant selection and corresponding texture analysis for the strain induced martensitic transformation during deformation of the parent austenite FCC phase to form the product HCP and the BCC martensite phases separately, obeying their respective orientation relationships. The automated method for reconstruction of the parent phase orientation using the EBSD data of the product phase orientation is done using the MATLAB and TSL-OIM software. The method of triplets was used which involves the formation of a triplet of neighboring product grains having a common variant and linking them using a misorientation-based criterion. This led to the proper reconstruction of the pre-transformation phase orientation data and thus to its micro structure and texture. The computational speed of current method is better compared to the previously used methods of reconstruction. The reconstruction of austenite from ϵ and α' martensite was carried out for multiple samples and their IPF images, pole figures, inverse pole figures and ODFs were compared. Similar type of results was observed for all samples. The comparison gives the idea for estimating the correct sequence of the transformation i.e. $\gamma \rightarrow \epsilon \rightarrow \alpha'$ or $\gamma \rightarrow \alpha'$, during deformation of AISI 304 austenitic stainless steel.

Keywords : variant selection, reconstruction, EBSD, austenitic stainless steel, martensitic transformation

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