Calculation of high temperature parent orientation maps application to low carbon steels

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The microstructures of low/medium carbon steels greatly depend on the austenitic (γ) processing and consecutive γ to α' (bainite or martensite) phase transformations. Unfortunately, it is rarely possible to analyse the γ microstructure from the small fraction of γ retained at room temperature.

Several methods have been applied to characterize the high temperature g microstructure. For example, Bechet-Beaujard etching reveals the austenitic microstructure but is highly irreproducible. Recently we proposed a reconstruction method that automatically calculates the parent orientation maps from the daughter maps in case of the ß to α transformation in Titanium and Zirconium alloys. Such a reconstruction method seems also promising in the case of steels. However, it needs to be adapted to the specificities of the γ to α' transformation.

In this contribution, we present our on-going developments to deduce the shape and orientation of the prior γ grains from the inherited α' maps. The method was applied to different α' microtextures measured by EBSD on TRIP or bainitic steels. It was possible to check the reliability of our calculations by comparing the recalculated γ maps to the experimental ones deduced from the low amount of γ retained at room temperature. The results show that, even with a large spread around the γ/α Orientation Relations, the shape and orientation of most of the γ grains are accurately calculated.