Characterization of strained materials: correlation between EBSD investigations and TEM observations.

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The aim of this talk is to illustrate, through several studies, how TEM and EBSD can be correlated to characterize cold rolled materials and materials produced by severe plastic deformation such as ECAE (equal channel angular extrusion).

1. In order to describe the primary recrystallization of a 40% cold rolled IF-steel, the characterization of the deformed state was perfomed by estimating the stored deformation energy "*E*" which is a first order parameter for primary recrystallization. Two complementary
methods based on neutron diffraction and TEM/EBSD observations were used to estimate this stored energy *E*. Neutron diffraction can be used mainly to estimate the stored deformation energy from the inside of subgrains whereas TEM and EBSD provide the sub-boundary energy. The effects of grain boundary energy have been ignored in this study [1].

2. The microstructure evolution of a two-phase austenitic-ferritic steel after hot rolling and then during cold rolling (reduction amounts: 20, 40, 60 and 80%) is investigated with the help of the FEG-SEM / EBSD technique. Special phases orientation relationships (Bain, K-S, N-W and G-T) evolution between neighbouring grains of □ and □ phases have been characterised as a function of the cold rolling reduction. As this later increases, fraction of the particular phase orientation relationships decreases. The same evolution is noticed for the □3 grain boundaries inside the □ phase. These results are compared to those observed by TEM [2].

3. The microstructure of a heavily deformed submicron grain copper, produced by ECAE, has been characterized using FEG/EBSD and TEM analyses. The microstructure is composed of clusters of elongated grains. This ECAE copper is not a true submicron grain alloy since still 60% boundaries are Low Angle Boundaries. As a result, grains grow with annealing to a stable size of about 2 µm [3].

References:

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