Diffraction Studies of Medium Manganese Steel Grades

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Samples from a medium manganese thermomechanical processed steel sheet show strongly preferred crystallographic orientations far from the random distribution. For the quantification of the retained austenite phase a novel X-Ray diffraction (XRD) based method is presented that calculates the phase fraction from the measured texture data. By a geometrical averaging procedure in a large area of the reciprocal space it is possible to define an orientation dependent phase fraction that can be related to the mechanical and magnetic properties along different directions. The structural information from XRD of the phases ferrite, retained austenite and epsilon martensite is used to setup a combined Electron Backscatter Diffraction (EBSD) and Energy Dispersive X-Ray detection (EDX) measurement on the scanning electron microscope (SEM). The distribution, shape and chemical composition of the phases is obtained with a high lateral resolution. The local misorientation of the EBSD data is calculated with a kernel averaging method for each phase and correlated to the experimental data of the residual stresses measurement by XRD along different directions. The results of this orientation dependent analysis can be used to improve the understanding of the physical phenomena and mechanical strengthening mechanisms of medium manganese steels. There is an attempt to describe the magneto-elastic interaction in the complex microstructure with ferromagnetic matrix and non-ferromagnetic retained austenite. Measurements of the residual stresses of the individual phases are compared before and after magnetization.