With the increasing demand for steel properties tailored to specific applications, understanding the microstructure development in all stages of the manufacturing chain becomes more and more important.

In order to get a deeper insight into the dynamic recrystallisation processes during hot rolling, a series of 12 differently deformed samples from Rastagaev compression tests have been examined by performing EBSD and SEM analyses after the test. As material, a fully austenitic high-Mn-steel of the composition X30MnAl23-1 was chosen. Cylindrical Rastagaev samples of a diameter of 10mm and a height of 15mm were compressed in a servo-hydraulic testing machine by Schenck at a temperature of 1050°C and a strain rate of 0.1/s. The analysed target strains ranged from 0.05 to 0.5 (cf. Fig. 1). In order to ‘freeze’ the state of microstructure evolution after the test, the samples were quenched in water directly after they had been deformed to their final height.

The SEM / EBSD analyses were performed with a Hikari camera by EDAX-TSL attached to a JSM-7000F by JEOL. The results (cf. Fig. 1) of the EBSD analyses clearly show the different degrees of microstructure evolution from the starting growth of subgrain boundaries at the existing high-angle grain boundaries to the growth of recrystallized grains. These observed microstructure changes are compared to existing models for the recrystallisation process (e.g. Ponge & Gottstein 1998).

Reference:

Acknowledgement: The authors gratefully acknowledge the support of the Deutsche Forschungsgemeinschaft (DFG) within SFB761 - Stahl ab initio: Quantenmechanisch geführtes Design neuer Eisenbasis-Werkstoffe.
Fig. 1: Stress over strain hardening rate- and stress over strain curve during the compression test and corresponding Kernel Average Misorientation plots, KAM(450nm,5°). (a) and (b) show subgrain boundaries growing from the large-angle grain boundaries. (c) and (d) show the presence and growth of recrystallised grains (marked in (c)).