

The effect of κ -carbides on the microstructure and properties of low-density steel

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Low density steels have been the subject of many studies in the past years. The current research is focused on the precipitation of κ -carbides upon different aging treatments of a Fe-30Mn-9Al-1C (wt.%). The precipitation and growth of these carbides is studied from under-aging treatments (550 °C for 2.5h) until over-aging (650°C for 8h) in different steps, after hot rolling. The fraction, morphology, and nucleation of these carbides are studied with the use of electron microscopy, while the austenite grain size and texture are studied with electron backscatter diffraction. The first results suggest that with prolonged aging, the κ -carbides can grow in size up to 0.8 μm , while for lower aging time and temperature, their diameter extends to only few nanometers (Fig. 1a, 1b). These microstructure features are correlated to the mechanical properties (hardness and tensile) of the steel (Fig. 1c). It is found that the κ -carbides contribute significantly to the strength and elongation of the material after short aging, but this is not the case for prolonged aging.

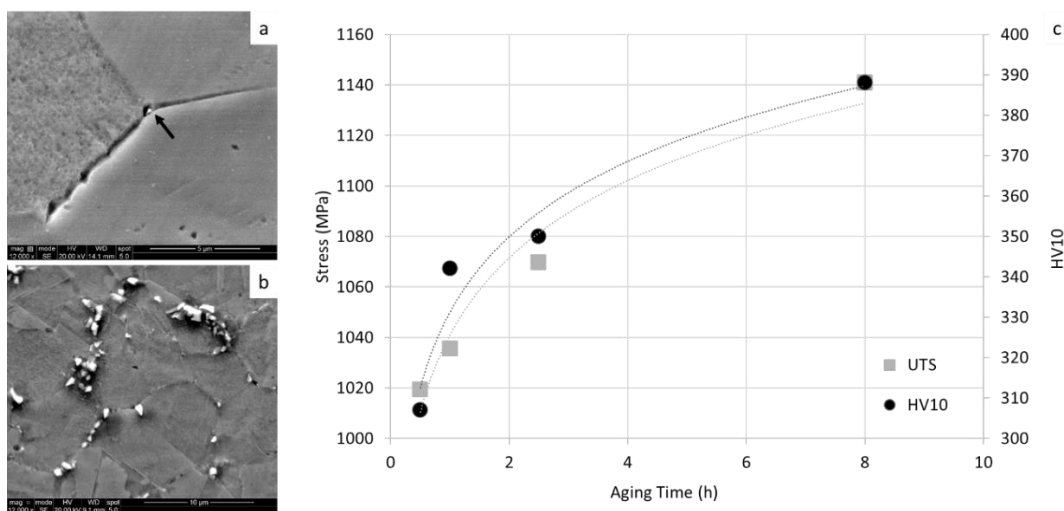


Fig. 1: SEM images of κ -carbides after aging at 550 °C for 8 h and after aging at 650 °C for 8 h. c) Evolution of the hardness and ultimate tensile strength of the steel during aging at 550 °C.

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