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Strain Induced Martensitic Transformation in Austempered Ductile Iron (ADI)

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Austempered ductile iron (ADI) is a nodular ductile iron which has undergone a special heat treatment to greatly enhance mechanical properties. This heat treatment process consists of austenitization, quenching to a temperature typically between 250℃ and 450℃ and isothermal austempering. Afterwards the microstructure consists of acicular ferrite and high carbon enriched retained austenite.
The high carbon enriched retained austenite can transform to martensite during plastic deformation. Austempering temperature and time as well as alloying composition control the retained austenite fraction, grain size and its stabilization, which in turn will influence the following martensitic transformation.
How different treatment and composition parameters influence the martensitic transformation has been investigated using in-situ neutron diffraction while applying either tension or compression to different plastic strains. In addition texture measurements using neutron diffraction have been performed to calculate the texture distribution of ferrite and austenite phases for different strain levels. Combining the detailed information on texture with the in-situ studies is necessary for quantitative phase analysis and extraction of martensite phase fractions.
Here we will present the results from these experiments which allowed us to develop a model of the martensitic transformation kinetic in ADI due to plastic strains with respect to austempering temperature and alloying element content.

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