304-213 Strain-induced martensite formation of an AISI 304L steel sheet: experiments and modeling

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Metastable austenitic stainless steels are subjected to strain-induced martensite transformation (SIMT) during deformation at room temperature, as in sheet metal forming processes. This SIMT is influenced by the chemical composition, grain size, temperature, deformation mode (or stress state) and strain-rate. In this work, interrupted (UI) and continuous (CU) uniaxial tensile tests were performed in an AISI 304L sheet to evaluate the SIMT as a function of strain (UI) and strain-rate (CU). The SIMT was measured by Ferritoscope, XRD and optical microscopy (OM) techniques. The SIMT kinetics was evaluated with thermo-mechanical FE simulations using a phenomenological model. For small strains, the yield stress increases with the strain-rate. Then, a cross effect in the stress-strain curve is observed since the SIMT is delayed due to the heat generation. Good correlations between XRD and OM measurements were obtained as a function of the Ferritoscope values, which corroborated this last technique.