

305-064

THE INFLUENCE OF TEMPERATURE ON MECHANICAL PROPERTIES, FRACTURE MORPHOLOGY AND STRAIN HARDENING BEHAVIOR OF A 304 STAINLESS STEEL

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The influence of temperature on the mechanical properties, fracture morphology and strain hardening behavior of 304 stainless steel was investigated through uniaxial tensile testing. A universal testing machine with an attached heating chamber was used for this work. Samples were strained until rupture at a strain rate of 10⁻³s⁻¹ and temperatures of 25, 50, 75, 100, 125 and 150°C, and fracture morphology was investigated through SEM. XRD analysis and Rietveld refinement were carried out on ruptured samples for phase quantification. The effects of temperature on the mechanical properties were assessed in terms of yield strength, uniform elongation and average strain hardening exponent. Strain hardening behavior was studied through a strain hardening rate, instantaneous strain hardening exponent and Crussard-Jaoul analysis. Mechanical properties generally declined with an increase in temperature and martensite formation ceased at approximately 100°C. Six strain hardening stages were detected at lower temperatures, posteriorly transitioning into three strain hardening stages at higher temperatures. Fracture surface was ductile at all studied temperatures, although dimple and void morphology reasonably differed.