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EFFECT OF ROLLING TEMPERATURE AND THICKNESS REDUCTION ON THE STRENGTH OF A 316L STEEL

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The relationship between microstructural changes and the yield strength of a 316L austenitic stainless steel subjected to plate rolling at temperatures of 200°C and 300°C with 40%, 60%, 85% and 95% rolling reductions was studied. The structural changes during rolling were characterized by the development of deformation twinning and micro-shear banding that led to a reduction of the transverse grain size. The martensitic transformation hardly developed during rolling at 200°C, when the martensite fraction did not exceed 5% after 95% rolling reduction, and did not occur at all during rolling at 300°C. The grain refinement was accompanied by an increase in the yield strength to 670 or 1240 MPa depending on the rolling regimes. The shape of the stress-strain curves also strongly depended on the rolling temperature and reduction. The shape of the stress-strain curve was characterized by a long plateau-like region right after yielding in the samples subjected to rolling at 300°C with 40% and 60% rolling reductions. A decrease in the rolling temperature and/or increase in the rolling reduction shortened plateau region followed by its disappearance. The effect of rolling conditions on the evolved microstructures and the mechanical properties is discussed in some detail.

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