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Microstructure and mechanical properties of austenitic stainless steels after cold rolling

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Abstract: The effect of austenite stability on the evolution of microstructure and mechanical properties of three austenitic stainless steels during cold rolling has been studied. Samples of different grain sizes have been used to characterize the microstructures during deformation. In the case of 304/8% Ni and 304/10% Ni stainless steels, the transformation microstructures consist of mechanical twins: ?-martensite and ??-martensite. No hexagonal close-packed (hcp) ?-martensite was detected in 316 stainless steel. The volume fraction of ??-martensite formed increases with increasing strain in 304 and 316 stainless steels for a given grain size. The amount of ?? phase increases with a decrease in grain size in 304 stainless steel, while the formation of this phase has been found to be grain size insensitive in 316 stainless steel. The strain-hardening behavior exhibited by the three stainless steels used in this study indicates the contribution of both ??-martensite and grain size strengthening in the case of both 304 stainless steels, while only grain size contribution was found in the case of 316 stainless steel.

Keywords : deformation twinning, slip, stacking fault energy, strain-induced martensite