Optimization of flow stress in cool deformed Nb-microalloyed steel by combining strain induced transformation of retained austenite, cooling rate and heat treatment

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In this study, cool deformation was incorporated in the overall thermo-mechanical processing of a Nb-microalloyed steel. Included in this was the effect of cooling rate subsequent to hot rolling on precipitate formation in the ferrite phase. The results show that increasing the cooling rate prevents precipitate formation in the ferrite phase at the cool deformation temperature. As well, the amount of retained austenite under the low cooling condition in the temperature range of cool deformation, 700–300 °C, was measured by neutron diffraction (shown in figure 1). It is then shown that strain-induced transformation of retained austenite to martensite is the main factor in increasing the strength of cool deformed Nb microalloyed steel. Combining accelerated cooling, strain-induced transformation of austenite to martensite during cool deformation and a subsequent heat treatment stage to increase precipitation maximizes the flow stress of the steel. Finally, it is shown that this process also lowers the yield strength/ultimate strength ratio.

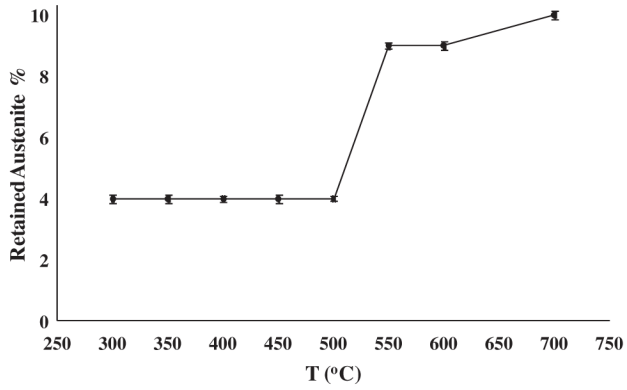

Fig. 1 Variations in retained austenite 5 min after reaching each temperature for a low cooling rate.

References

[1] S.H. Mousavi Anijdan, Dimitry Sediako, Steve Yue. Optimization of flow stress in cool deformed Nb-microalloyed steel by combining strain induced transformation of retained austenite, cooling rate and heat treatment. Acta Materialia 60 (2012) 1221–1229.