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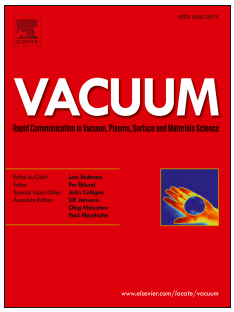

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ACCEPTED MANUSCRIPT

Flow curves, dynamic recrystallisation and precipitation in a medium carbon low alloy steel

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Abstract

In this study, hot compression tests were performed at temperatures in range of 850-1150 °C and strain rates of 0.001-100 s^{-1} to study the hot deformation behavior of 26NiCrMoV 14-5 steel. The relationship between flow stress, temperature and strain rate was established using a power-law equation and the activation energy was determined in range of 200-600 kJ/mol. Some irregularities were observed in the activation energy and peak strain at temperatures below 1000 °C and low strain rates (< 1 s^{-1}). Optical microscopy observations confirmed the absence of dynamic recrystallisation (DRX) at the mentioned condition. Stress relaxation tests and TEM observations showed that dynamic precipitation (DP) of carbide particles would be responsible for partial dynamic recrystallisation in low temperature-low strain rate regime. Unlikely, at high temperatures DP was absent and complete DRX was obtained. The results showed that the power dissipation and instability maps are nearly insensitive to DP. The complete processing-microstructure map showed a possible instability region at 850 °C and strain rate of 100 s^{-1}; and other deformation regimes would lead to the safe deformation. The region of interaction between DP and DRX was introduced at temperatures below 1000 °C and strain rates below and 1 s^{-1}.

Key Words: Hot compression; Dynamic recrystallisation; Low alloy steel; Microalloyed; Constitutive analysis.

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