Hot deformation characteristics and processing map analysis for Nickel-based corrosion resistant alloy

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Hot deformation characteristics and processing map analysis for Nickel-based corrosion resistant alloy

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Abstract: The hot deformation behavior of Nickel-based corrosion resistant alloy was studied in the temperature range of 950 to 1200℃ and the strain rate range of 0.001 to 10s^{-1} by employing hot compression tests. The results show that the peak stress increases with decreasing temperature and increasing strain rate, and the activation energy is about 465kJ/mol. The processing maps were prepared on the basis of flow stress data. In order to understand the correlation between dynamic recrystallization (DRX) phenomena and efficiencies of hot working domains, the volume fraction of DRX and the grain size in each domain were evaluated. It is observed that the efficiency peaks of the stable domains are associated with DRX nucleation process at high strain rate, with DRX nucleation and growth process at low strain rate and temperature, and with DRX growth process at low strain rate and high temperature. Under the lower temperatures and intermediate strain rates (domain F), the dynamic precipitated sigma phase assists in nucleating DRX and results in the typical "necklace" structure. Finally, the optimum hot working conditions for Nickel-based corrosion resistant alloy are suggested to be based on the processing map.

Key words: Processing map, Dynamic recrystallization, Precipitation, The 028 alloy

1. Introduction

Nickel-based corrosion resistant alloys, due to their excellent mechanical properties at elevated temperatures, good corrosion resistance and high specific strength [1-3], have been used to produce oil pipes in petroleum industry extensively. Usually, the outstanding properties of these alloys depend on the microstructures which can be controlled by tuning the hot working parameters such as deformation temperature, strain rate and strain [4,5]. Recently, researches in this field focus mostly on Ti alloys [6], Mg alloys [7], Nb-V micro-alloyed steels [8], HLSA alloys

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