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Effect of rare earth on the niobium carbide dissolution and precipitation in low-carbon microalloy steels

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ABSTRACT

The effect of rare earth on the Niobium Carbide dissolution and precipitation during the hot rolling process in the Low-Carbon Microalloy steels was investigated in this paper. The austenite grain coarsening and Niobium carbide precipitation behavior under different heating temperature were contrasted through the TEM microstructure observation. In addition, thermodynamic solid solubility calculation was carried out to obtain the solubility product of niobium carbide. Furthermore, the influences of rare earth on Niobium carbide precipitation behavior were also characterized by means of the first principles calculation based on the density functional theory (DFT), to clarify the acting mechanism of rare earth fundamentally. The results indicate that appropriate conditions additions of rare-earth elements can reduce the temperature of austenite grain growth during the heating process and promote the carbonitrides dissolving in the low-temperature zone as well, such an addition of lanthanum resulted in an improvement of Niobium elements utilization in the process of controlled rolling and controlled cooling.

KEYWORDS: rare earth, microalloy steels, carbide, dissolution, precipitation