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Study on the effects and mechanisms of induction heat treatment cycles on toughness of high frequency welded pipe welds

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Abstract:

The low toughness of the high frequency welded pipe welds seriously affects the performance of the welded pipe. Two induction heat treatment cycles of quenching + tempering (Q&T) and similar normalizing (SN) were put forward in this paper to study the toughness of the high frequency welded pipe welds. The effect of heating rate on the phase transition temperatures (Ac_1 , Ac_3) of the raw material of the high frequency welded pipe was studied and the reasonable ranges for heat treatment parameters were determined. It was found that the austenite transformation temperatures increase with the increase of heating rate. For the heating rate of $200^\circ\text{C}/\text{s}$., Ac_1 and Ac_3 were determined as 769°C and 920°C , respectively, and then the specific heat treatment parameters for Q&T and SN were determined. The mechanical properties of the base metal, as-welded, Q&T and SN treated welds were obtained by tensile and impact tests. The optimum heat treatment parameters corresponding to Q&T and SN respectively were determined based on the principle of a good matching of strength and toughness of the welds.

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