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Heat Transfer of Ca (NO3)2-KNO3 Molten Salt Mixtures for Austempering and Martempering Processes of Steels
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Abstract
Molten salts are highly effective as a quenching medium for austempering and martempering processes, enabling precise control of cooling rates to achieve the desired microstructures and mechanical characteristics in steel components. One such promising molten salt is a multicomponent Ca (NO3)2-KNO3 molten salt. The current work explores the cooling severity of molten Ca (NO3)2-KNO3 mixtures, which are commonly used for such purposes. The said mixture, with varying concentrations and bath temperatures was used for quenching the Inconel probe with thermocouples. The temperature data extracted was used to determine the transient heat flux developed at the metal-quenchant interface. A set of critical points were assessed against the peak heat extraction rates. Additionally, the fluctuation of mean heat flux and surface temperature in relation to these crucial points were plotted, along with changes in composition and bath temperature of the quench media. The cooling intensity of these quench solutions, as measured by Inconel probes, correlated well with the average hardness values observed in steel probes. The level of homogeneity in heat transmission, as measured by the spatial variance of the normalized heat energy, decreased as the percentage of KNO3 in the quench medium increased. © 2024 The Authors. Published by American Chemical Society.

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