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C, Mn partitioning behavior and its effect on microstructural evolution of low-carbon Si–Mn steel in I&Q process

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ABSTRACT

The C, Mn partitioning behavior and its effect on microstructural evolution of low-carbon Si–Mn steel after I&Q processes with different intercritical annealing time were studied, by means of electron microprobe analysis (EMPA), field emission scanning electron microscopy (SEM), and energy dispersive spectrometer (EDS) in combination of thermodynamic calculation. The results show that in the continuous heating stage, C, Mn content in austenite presents a trend of decline with temperature increasing; after intercritically annealed at 800°C for 5 min, C and Mn enriches in austenite, and the distribution is uniform in austenite; the concentration difference of C in two phases becomes more obvious when the annealing time extended to 30 min, and the distribution in austenite presents uneven, the enrichment degree of Mn in austenite is also improved; under the drive of chemical potential gradient, C and Mn partition from ferrite to austenite to make the chemical potential balance in the two phases; the organization at room temperature is composed of ferrite and martensite plus a small amount of M/A islands after I&Q process, Mn partitioning has influence on the growth of austenite by making it grow in three forms of strip, block, and clumps.

KEYWORDS: low-carbon Si–Mn steel, I&Q process, C partitioning, Mn partitioning, microstructural evolution