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Effects of cooling rate on the microstructure and properties of coarse-grained zone in complex steel 780HE

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A thermomechanical simulator Gleeble-3800 was used to simulate the thermal cycles experienced by 800 MPa-grade complex phase steel 780HE under different $t_8/5$ during the welding process, and systematically studied the effects of cooling rates on the microstructure, precipitates, and mechanical properties of the coarse grain zone. Results showed that the coarse grain zones were composed of bainite at different $t_8/5$. As the $t_8/5$ decreased, the initial transformation temperature of austenite decreased, making the main microstructure changed from granular bainite to lath bainite, and the dislocation density increased. The cooling rate had no significant effect on the types of precipitates in the coarse grain zone, and they were mainly composed of nearly circular composite precipitates $(Ti,Nb)C$ accompanied by several square precipitates $(Ti,Nb)(C,N)$. As the cooling rate increased, the maximum tensile strength decreased, the uniform elongation and impact toughness increased. When $t_8/5$ decreased to 30s, the change was no longer significant.