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MICROSRUCTURE AND MECHANICAL PROPERTIES OF A MODIFIED P911-TYPE STEEL WELD JOINT

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Welding is a common process in pipelines fabrication of high-chromium martensitic steels, which are used as heat-resistant material in modern power plants. The quality of weld joints depends significantly on appropriate welding consumables. In the present work, plates of P911-type steel were preheated to 250°C and welded using similar filler material with high boron and low nitrogen contents. Post-weld heat treatment was carried out at 760°C for 3h. Tensile properties of the weld joint at temperatures up to 760°C, microhardness profile across the weld joint and Charpy toughness in different weld portions were obtained. The joints were studied in detail by optical and transmission electron microscopy.

The weld zone is characterized by hardness of about 300 HV. The highest values of toughness were observed in the heat-affected zone and base material. At room temperature, the YS, UTS and δ values were 470 MPa, 670 MPa and 13 %, respectively. With increasing test temperature to 760°C the YS and UTS decreased to 130MPa and 150MPa, respectively, and elongation to rupture increased to 18%. A decrease in dislocation density and subgrain growth was observed in the heat-affected zone after post-weld heat treatment. Obtained results could be used for the development of optimal weld regimes for advanced P911-type steels.