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Microstructural optimization and mechanical behavior of SS-QP treated 30CrNiMo8 steel

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The quenching and partitioning (QP) process aims to achieve superior mechanical properties and enhanced toughness by developing a microstructure consisting of martensite and retained austenite. In this study, single-step (SS) QP treatments were applied to the commercial 30CrNiMo8 steel, a material widely used in industrial high-strength applications but not specifically engineered for this process. Preliminary studies on the initial microstructure are performed through the application of different austenitization parameters. Microstructure evolution was examined using XRD and SEM/EBSD, while tensile tests were conducted to evaluate the impact of the treatment on the final properties of the material. SS-QP treatments were successfully implemented, delivering high tensile strength and improved ductility. Strain hardening behavior was analyzed and compared with specimens treated using conventional quenching and tempering treatments. The results demonstrate the feasibility of applying the QP process to 30CrNiMo8 steel and highlight the importance of initial microstructural control and treatment design in achieving desired mechanical performance.

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