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Precipitate phases in ferritic/martensitic steel P92 after thermomechanical treatment

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(Yinzhong Shen)

Abstract

Thermomechanical treatment (TMT) can effectively improve the mechanical properties of 9–12% Cr ferritic/martensitic (F/M) steels. To understand the effect of TMT on the creep properties of the steels, precipitate phases in the steels produced by TMT require investigations. A TMT process, including austenization at 1373 K (1100 °C) for 2 h, followed by warm-rolling at 923 K (650 °C) plus tempering at 923 K (650 °C) for 1 h, was applied on a commercial F/M steel P92. Precipitate phases in the steel after the TMT were investigated by transmission electron microscopy. Nano-sized Cr-rich $M_2(C,N)$ carbonitride with a high number density was the dominant phase. Large-sized Nb-rich $M(C,N)$, $(Nb_{0.8}V_{0.13}Cr_{0.05}Mo_{0.02})(C,N)$, and nano-sized Nb-V-rich $M(C,N)$ carbonitride phases with the same f.c.c. crystal structure were identified. Identified Cr-rich $M_{23}C_6$ carbides with a typical composition of $(Cr_{0.68}Fe_{0.25}W_{0.04}Mo_{0.03})_{23}C_6$ have a large size and less amount. Modified Z-phase,

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