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EFFECT OF SHORT-TERM AGING ON THE IMPACT TOUGHNESS OF ADVANCED 10% CR STEEL

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Heat-resistant high-chromium martensitic steels are widely used in various critical components of fossil power plants due to their superior creep resistance and high-temperature strength. High fracture toughness is an important property to assure the reliability of steam turbine parts produced from these steels. In this work, the effect of short-term aging (100 h) at 650°C on the temperature dependence of impact toughness and fracture behavior of advanced 10% Cr steel with low N and high B contents was studied. The steel in tempered condition exhibits the ductile-brittle transition temperature (DBTT) of ~10°C and the Charpy V-notch impact energy of 240 J/cm^2 at room temperature. Aging for 100 h at 650°C leads to the increase in the DBTT to 35°C and decrease in the impact toughness at 20°C to 90 J/cm^2. Effect of the fine Laves phase particles (with size < 100 nm) precipitated at lath/grain boundaries on the impact toughness is analyzed. The Laves phase particles serve as additional nucleation sites for microcracks/voids facilitating unstable crack propagation. This is the main reason for decreasing the stable crack propagation energy and impact toughness of the steel.