EFFECT OF AGEING TIME ON THE TENSILE PROPERTIES OF THE LOW-CARBON 9% CR MARTENSITIC STEEL

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The structure and tensile properties of the tempered martensite/ferrite lath structure of the low-carbon 9 wt.% Cr heat-resistant steel with high N and low B contents after ageing at 650°C for 3000 h were investigated. Previously, the steel investigated was heat treated consisting normalizing at 1200°C with following tempering at 750°C for 3 h. After heat treatment, tempered martensite/ferrite lath structure of the 9%Cr steel with a mean size of martensitic laths of 297±30 nm and dislocation density in lath interior of 4.6×10^{14} m^{-2} was revealed. The boundaries of martensitic laths were stabilized by fine "Cu"-rich particles with a mean size of 55±10 nm and TaX carbonitrides with a mean size of 11±2 nm. The tensile tests were carried out at room temperature. The yield strength and ultimate tensile strength were 670±40 MPa and 750±40 MPa, respectively, after heat treatment. Ageing at 650°C for first 500 h insignificantly decreased the yield strength on 40 MPa that was related to annihilation of dislocations. An increase in ageing time up to 1000 h led to an decrease in the yield strength on 110 MPa that related to the depletion of W from the ferrite matrix. After 3000 h of ageing, the coarsening of laths and TaX particles took place that led to a decrease in yield strength by 6%, while the tempered martensite lath structure retained without subgrain formation. No significant softehing during 3,000 h of ageing at 650°C was observed that indicated high thermal stability of tempered structure of the low-carbon 9%Cr steel at thermal exposure. The relationship between structure and tensile properties of samples aged with different times was evaluated; the effect of ageing time on the strengthening mechanisms was discussed.

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