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ANALYSIS OF CREEP BEHAVIOR OF TA-CONTAINING 12%CR HEAT-RESISTANT MARTENSITIC STEEL AT ELEVATED TEMPERATURE

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Ta-containing 12% Cr-3% Co martensitic steel is a prospective candidate for blades of steam turbines, which are able to work at ultra-supercritical parameters of steam [1]. The main problem of using of the 12% Cr steel is their structure instability during creep in comparison with 9% Cr steels [2]. Creep tests for Ta-containing 12% Cr steel were carried out at 650°C under the applied stresses of 200-100 MPa with a step of 20 MPa. The addition of 0.07%Ta together with decreasing Nb content to 0.04% significantly increases the creep resistance at 650°C and high applied stresses. No any drops on curves of Applied stress vs. Time to rupture and Minimum creep rate vs. Applied stress are revealed. The creep data can be described by power-law creep equation:

$$\dot{\epsilon}_{min} = A \times \sigma^n \exp\left(-\frac{Q}{RT}\right) \quad (1).$$

where $\dot{\epsilon}_{min}$ is minimal creep rate, σ is an applied stress, n is exponent constant, Q is activation energy for plastic deformation, R is gas constant and T is absolute temperature. Exponent constant of n is 7 with regression coefficient of 0.98 for the applied stresses of 200-80 MPa at 650°C. Minimal creep rate decreases from 10^{-11} to 10^{-6} s^{-1} , when the applied stress decreases from 200 to 80 MPa at 650°C. The 100,000 h creep rupture strength predicted by Larson-Miller parameters ($c=36$) is 86 MPa on base of 10,000 h. This value is preliminary and requires the correction with longer creep tests. Moreover, for 9% Cr-3% Co steels [3], the 100,000 h creep rupture strength is 85-86 MPa that indicates high thermal structural stability of new Ta-containing 12% Cr-3% Co steel.

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1. H.K.D.H. Bhadeshia, Design of ferritic creep-resistant steels, ISIJ Int. 41 (2001) 626-640.
2. J. Hald Creep strength and ductility of 9 to 12% chromium steels, Materials at high temperature 21 (2004) 41-46.
3. A. Fedoseeva, N. Dudova, R. Kaibyshev, A. Belyakov, 2017. Effect of Tungsten on Creep Behavior of 9%Cr–3%Co Martensitic Steels. Metals. 7, 573.