ТЕЗИСЫ ДОКЛАДОВ

МЕЖДУНАРОДНАЯ КОНФЕРЕНЦИЯ
«Физическая мезомеханика. Материалы с многоуровневой иерархически организованной структурой и интеллектуальные производственные технологии»

6–10 сентября 2021 г.
Томск, Россия

Томск – 2021
Издательство ТГУ

DOI: 10.17223/978-5-907442-03-0-2021-216

SHORT-TERM CREEP PROPERTIES OF 10%Cr-3%Co STEEL ON MICROALLOYING WITH RHENIUM AND COPPER

Fedoseeva A.E, Nikitin I.S.
Belgorod National Research University, Belgorod

9-10%Cr martensitic steels are considered to be prospective materials, which are able to withstand high temperature and stresses, for the elements of pipes, tubes, main lines and others of power units of fossil power plants worked under the ultra-supercritical steam conditions. The Re-containing 10Cr-3Co-2W-0.8Cu-0.2Re steel subjected to normalizing at 1050°C and tempering at 770°C demonstrates improved creep strength under the high applied stresses at 650°C compared with Re- and Cu- free 10Cr-3Co-2W steel and Re-containing 10Cr-3Co-3W steel. Increases in creep rupture time of Re-containing 10Cr-3Co-2W-0.8Cu-0.2Re steel comprised 8 and 4 times for creep tests in the case of 650°C/200 MPa and 650°C/180 MPa, respectively, compared with Re-containing 10Cr-3Co-3W steel. Such increment in creep rupture time had good correlation with an increase in the yield strength and ultimate tensile strength of new steel. The tensile tests of Re-containing 10%Cr steels in tempered state at 20°C and 650°C revealed that Re does not contribute to solid solution strengthening; the main reason of such enhanced creep resistance of Re-containing 10%Cr steel during short-term creep is the formation of dense chains of the fine Laves phase particles located along the low-angle lath boundaries that restricts the migration of the lath boundaries under the applied stress. Growth of Laves phase with formation of the large particles of 200-250 nm decreases the particle density along the lath boundaries and facilitates the detachment of these boundaries from the boundary particles that decreases the creep resistance of the Re-containing 10Cr-3Co-3W steel during long-term creep. Addition of copper in the chemical composition of the Re-containing steel is considered to be the factor suppressing the growth of Laves phase during creep at elevated temperature. Analysis of creep properties of the Re-containing steels in comparison with Re-free 10Cr2W steel will be discussed.

The study was financially supported by the Russian Science Foundation, under grant No. 19-73-10089.