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Effect Of Irradiation Temperature And Dose On SHC Of Pure Cu

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Pure Cu and copper alloys (CuCrZr\textsubscript{IG}, GlidCop\textsubscript{Al25IG}) are suggested for application in high heat flux components of the ITER divertor and blanket. These materials operate under high thermomechanical loads and neutron irradiation. Radiation hardening and embrittlement of pure copper are sufficiently well investigated; as for CuCrZr-type copper alloys the data base on radiation resistance is scarce. At the same time, such important problem as the effect of neutron irradiation on stress-hardening coefficient (SHC) of pure Cu and copper alloys is poorly investigated, though these data are important for calculation of stress-strained state of the ITER components.

This paper presents the results of systematic investigation into the effect of neutron irradiation temperature and dose on SHC of pure Cu and Cu alloys.

Samples were irradiated in the SM-2 and RBT-6 reactors to doses of $10^{-3}$ - 2 dpa at irradiation temperature of 80\,°C, 150\,°C, 200\,°C, 300\,°C.

The results of processing of digital true stress-strain curves of pure Cu shows that under neutron irradiation in the range of 80-200\,°C SHC decreases monotonously with increase in irradiation dose and is reduced fivefold at $10^{-1}$ dpa as compared with the initial value. For CuCrZr alloy SHC decreases by about a factor of 3 at T\textsubscript{irr} = 300\,°C of pure Cu and CuCrZr alloy changes only slightly (decreases by 10- 20\%) up to a dose of 2 dpa.

The formula determining the correlation between the value of uniform elongation and SHC of materials is proposed. Good agreement is observed between the calculations and the experimental measurements of the uniform elongation of irradiated materials.

The conclusion is made that degradation in SHC under irradiation for copper alloy should be taken into account when calculating the stress-strained condition of elements of ITER components.