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Wed-Af-Po3.14-01 [1]: The Study of Strengthening and the Electrical Resistivity of Deformation Processed Cu/Cu-16%Nb and Cu/Cu-7%Nb Microcomposites

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The wide range of tensile strength values (1000-1700 MPa) simultaneously with the electrical conductivity of 55-75% of the international standard for annealed copper (IACS) are required for commercial Cu-Nb wires. For the industrial production, the optimal combination of physical properties must be supplemented with the reasonable cost. One of the ways to reduce the price of products can be the manufacture of wires with a reduced content of Nb. Mainly researches is devoted to the study of composites with a narrow range of Nb fracture (16-20%).
In the present study, we compare two composites with a standard niobium content Cu/Cu-16%Nb and with a lower one - Cu/Cu-7%Nb. The effects of deformation of these microcomposite wires on microstructure and physical properties are studied. The low Nb fraction allows to achieve the higher level of cold deformation up to 12 in comparison with 8,6 for Cu/Cu-16%Nb wire. The upper limit of tensile strength is 1200 MPa and 1500 MPa for Cu/Cu-7%Nb and Cu/Cu-16%Nb accordingly. The level of electrical resistance for maximum deformation is approximately the same for both wires. However, in the range of deformations far from the maximum, the combination of strength and conductivity is the same.
For both wires, a stepwise dependence of the electrical resistivity on the deformation is observed at a cryogenic temperature (10 K). This is speculated as an evidence for non-monotonic formation of the Cu/Nb interface.
These composites demonstrate a phase transition to the superconducting state and temperature of the phase transition decreases with increasing deformation. However, at extremely high deformations for the composite with reduced niobium content, an unexpected effect of increasing the critical temperature is found. The reasons for this behavior are discussed in relation to microstructure features of Cu/Cu-7%Nb wire.

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