Reviews on Advanced Materials Science 2016 vol.45 N1-2, pages 20-27

Microstructure transformation in a cast Cu-Fe alloy at high pressure torsion deformation

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Abstract

© 2016 Advance Study Center Co. Ltd.The effect of high pressure torsion (HPT) on the microstructure of Cu-Fe 36 wt.% alloy has been studied. The initial Cu-Fe alloy has a dendritic structure, the length of dendrites is up to 100 μm. As a result of HPT (20 anvil revolutions at 400 °C) a nanostructural state is formed. The average size of the Cu and α-Fe grains is 60 and 35 nm correspondingly. The volume fraction of the Fe phase reduces from the initial 37% down to 15% after HPT. The concentration of iron dissolved in the copper lattice reaches 20%. The subsequent annealing at 700 °C for 1 hour results in some coarsening of α-Fe particles, as compared to the state after HPT. However, the typical dendritic structure of the cast alloy does not recover; it remains dispersed with the size of α-Fe particles less than 20 μm. As a result of HPT the alloy microhardness increased from 1800 to 4000 MPa. The subsequent annealing at T = 700 °C decreased the microhardness to 2700 MPa, but this value is 1.5 times higher than that in the initial as cast state.