NANOCRYSTALLINE Cu-FREE HITPERM ALLOYS WITH IMPROVED SOFT MAGNETIC PROPERTIES

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We have studied the microstructure and magnetic properties in $Fe_{44.5}Co_{44.5}Zr_7B_4$ nanocrystalline alloys. The amorphous/crystalline transformation has been investigated by DSC–calorimetry, transmission electron microscopy and X–ray diffraction. Two distinct crystallization steps, which corresponds to the crystallization of α'–FeCo phase (T_{x1} = 501 °C) and $(Fe,Co)_3Zr$ phase (T_{x2} = 684 °C) have been observed. The $\alpha \to \gamma$ structural transformation of the FeCo phase was detected at 990 °C. Typical size of the nanograins in the optimum heat treated samples has been determined to be about 25 nm. The magnetic properties have been studied by VSM–magnetometry in the temperature range 300 K – 1100 K. The samples in the advanced crystallization stages exhibit at room temperature the saturation magnetization of about 180 Am^2/kg. The measurements of the hysteresis loops have been performed in temperature range 300 K – 700 K. We have found that this system exhibits fairly low values of coercive field ($H_c < 30\ Am^{-1}$) in the whole temperature range investigated. These values of coercive field are markedly lower than those previously reported for the HITPERM-type materials containing Cu.