Influence of Nb and Mo substitution on the structure and magnetic properties of rapidly quenched $Fe_{79.4}Co_5Cu_{0.6}B_{15}$ alloy

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In the present work, comprehensive structural and magnetic studies of the vacuum- and air-annealed, followed by rapid quenching $Fe_{79.4}Co_5Cu_{0.6}B_{15}$ ribbons, modified by Nb and Mo (1,3,5 at.%) have been reported. All these alloys were firstly produced in the pure amorphous state via melt spinning technique, and then characterized by X-ray diffraction and differential scanning calorimetry methods. Based on these results, the annealing process has been optimized in the temperature range between 260 and 500°C towards improving the magnetic properties (saturation induction (Bs), coercivity (Hc), core power losses at 1T and 50 Hz ($P_{10/50}$)). The local and average crystal structures were investigated by the X-ray diffraction complemented by transmission electron microscopy observations proving the nanocrystalline phase embedded in the glassy matrix, however with the crystal growth rate restricted to only an early stage of crystallization. Additionally, the magnetic properties of air-annealed samples are compared against the vacuum annealed counterparts. Finally, the local crystal structure of the vacuum- and air-annealed alloys have been characterized by transmission electron microscopy.

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