Effect of Si Content on Magnetic Properties of Short-Term Annealed FeCuBPSi Alloys

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Abstract. The effect of Si on magnetic properties of the rapidly quenched alloys $Fe_{82-x}Cu_1B_{10}P_3Si_{4+x}$ with x= 0 and 4 at % after short-term annealing (duration 5 minutes) has been investigated. Different Si content showed a significant effect on the magnetic properties and the microstructure after short-term annealing. Annealing at the temperature of the first onset of crystallization has the advantage of increasing the magnetic saturation while the coercivity is significantly lower for Si 8 at % than Si 4 at % alloy. The results of XRD and TEM measurements confirmed the nanocrystalline structure with bcc-Fe phase for both investigated alloys after short-term annealing. Analysis showed the smallest average grain size 20 nm for Si 8 at % sample annealed at 500°C. The upright shape of the hysteresis loops was already evident after lower temperature annealing, while the highest saturation magnetic polarization is most pronounced after 500° C annealing. The best saturation magnetic polarization values of 1.70 T were observed for the nanocrystalline alloy containing 4 at % Si.