Structural and magnetic phase transitions in amorphous $Fe_{81-x}Ni_xZr_7B_{12}$ (x=0, 20) alloys

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We present characterization of the structural changes accompanying magnetic phase transitions in two melt-spun ribbons. The subject of study is a typical NANOPERM alloy with the stoichiometry $Fe_{81}Zr_7B_{12}$ and the $Fe_{61}Ni_{20}Zr_7B_{12}$ alloy where the Fe atoms are partially replaced by Ni [1, 2]. The alloys have been produced by melt spinning technique in inert atmosphere. They have been studied in the glassy state by VSM and/or alternate current magnetometry in the temperature range from room temperature (RT) to 800ºC. The results are compared with differential scanning calorimetry (DSC) as well as XRD data.

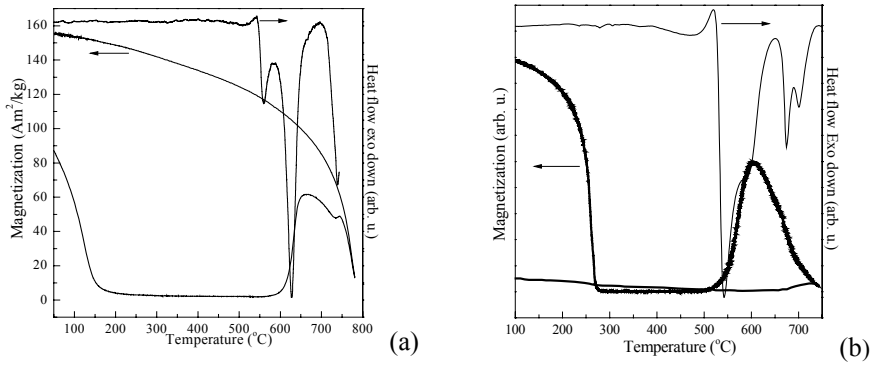

Fig. 1. Comparison of magnetization measurements and differential scanning calorimetry scans *versus* temperature for $Fe_{81}Zr_7B_{12}$ (a) and $Fe_{61}Ni_{20}Zr_7B_{12}$ (b) alloys.

As shown in Fig. 1a the ribbon x=0 has been heated continuously at 10 K/min to temperature 800°C and the ribbon x=60 at 50 K/min to 750°C. For the alloy with x=0 from about 550°C the crystallization process starts as can be clearly seen by thermomagnetic measurements and in DSC scans. The nanocrystalline bcc-phases are formed due to annealing up to the first crystallization stage for both alloys [1, 2]. Nanocrystalline bcc-Fe grains are formed during this heat treatment which results in a significant enhancement of the magnetization values. The XRD investigation of isothermally treated $Fe_{61}Ni_{20}Zr_7B_{12}$ ribbons has shown formation of a bcc-structure at 520°C and fcc-(Fe,Ni) + borides at 700°C. Reduction in the magnetic moment nearly to zero for this alloy is connected with formation of Fe-Ni nanocrystals with 25 at.% Ni which are paramagnetic at RT [3].

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