Crystallization processes in amorphous $R_{4.5}Fe_{77}B_{18.5}$ (R=Ce, Pr, Nd, Tb) ribbons

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The amorphous $R_{4.5}Fe_{77}B_{18.5}$ (R=Ce, Pr, Nd, Tb) alloys have been prepared by melt-spinning technique under argon atmosphere on a cooper wheel rotating with 25 ms^{-1}. The ribbons have been investigated by means of differential scanning calorimetry (DSC), X-ray diffraction (XRD) and thermomagnetic measurements. DSC measurements have been realized at different heating rates from 10 to 50 K/min (Fig. 1). The crystallization temperatures of the amorphous alloys have been found to be different for different content of rare earth elements. The magnetic properties has been analyzed by using of an alternate current magnetometer and compared with DSC results. DSC curves clearly show the glass transition and crystallization temperatures.

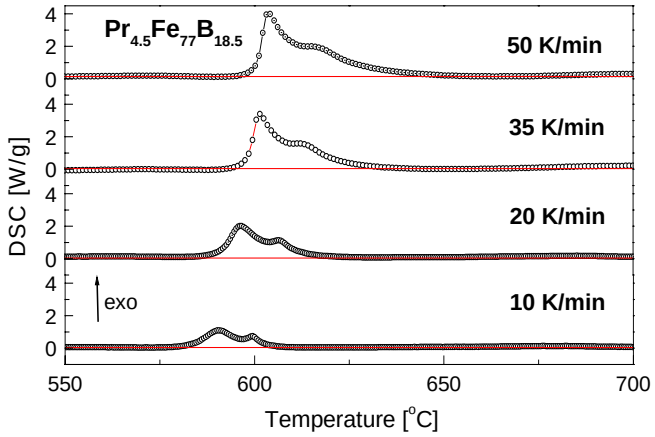

Fig. 1. The influence of heat flow on the shape and position of the differential scanning calorimetry curves for the $Pr_{4.5}Fe_{77}B_{18.5}$ ribbon.

The identification of the structural phases has been made by analysis of X-ray diffraction patterns. In the amorphous ribbons investigated initially Fe_3B alloy crystallizes and the crystallization of $Pr_2Fe_{23}B_3$ particles occurs immediately after Fe_3B formation. Then, fine hard magnetic $Pr_2Fe_{14}B$ particles nucleate at Fe_3B interfaces directly [1]. In further crystallization processes, $Pr_2Fe_{14}B$ and $Pr_2Fe_{23}B_3$ particles grow by the coalescence of fine particles [2].

[1] Y-C. Jung, Y. Ohmori, K. Nakai, S. Hirosawa, H. Kanekiyo, Mater. Trans. **43** (2002) 660
[2] ibid at **42** (2001) 2102

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