Pressure dependence of magnetic properties in Fe-Mn-B amorphous alloys

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Amorphous alloys of the nominal composition of $Fe_{80-x}Mn_xB_{20}$ (x = 10, 15, 18, 20 and 24 at%) were prepared by melt spinning in vacuum. Their crystallization properties were studied by differential scanning calorimetry (DSC). The magnetic properties at ambient pressure were investigated using a MPMS-5S SQUID magnetometer up to 5 T and a home-made ac susceptometer in the temperature range of 5 K < T < 300 K. Magnetization measurements under high hydrostatic pressure up to 12 kbar were performed in the SQUID magnetometer using a miniature piston-cylinder CuBe pressure cell. [1].

The $Fe_{56}Mn_{24}B_{20}$ alloy shows two characteristic magnetic transitions at ambient pressure: (1) the paramagnetic (PM)-ferromagnetic (FM) transition at the Curie temperature T_C = 163 K and (2) a spin freezing at temperature T_f = 13 K. The temperature T_C remarkably decreases with increasing pressure, dT_C / dp = -2.3 K/kbar as illustrated in Fig.1. Both, the low field magnetization measured in a magnetic field of 10 Oe (Fig. 1) and the saturated magnetization measured at 5 K in a magnetic field up to 5 T decreases with increasing pressure.

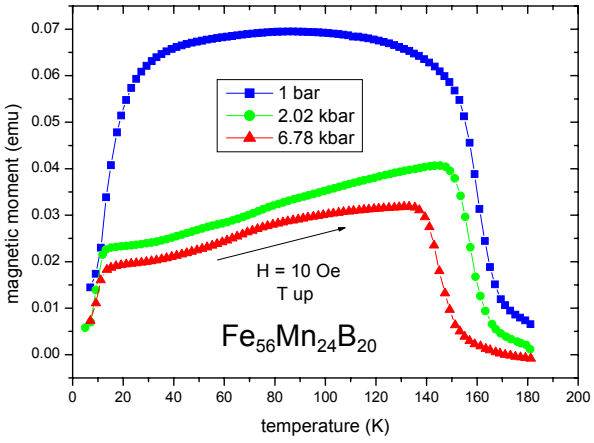

Figure 1: Temperature dependence of magnetic moment for $Fe_{56}Mn_{24}B_{20}$ after zero-field cooling measured in a field of 10 Oe at three different pressures indicated in the figure.

In the paper, the influence of pressure on the magnetic properties of the amorphous alloy series is discussed in the light of itinerant electron models of ferromagnetism and compared with literature results [2].

[1] J. Kamarád, Z. Machátová and Z. Arnold, Rev. Sci. Instrum. **75** (2004) 5022-5025.

[2] J. Schiller and R. Wisniewski, J. Magn. Magn. Mater. **80** (1989) 318-320.

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