

Tuning the magnetocaloric response in Gd-rich amorphous alloys

Z. Śniadecki,¹ N. Lindner,² M. Kołodziej,^{1,3} J.-M. Grenèche,⁴ J. Marcin,⁵
I. Škorvánek,⁵ and B. Idzikowski¹

¹*Institute of Molecular Physics, Polish Academy of Sciences,
M. Smoluchowskiego 17, 60-179 Poznań, Poland*

²*Faculty of Physics, Adam Mickiewicz University,
Uniwersytetu Poznańskiego 2, 61-614 Poznań*

³*NanoBioMedical Centre of Adam Mickiewicz University,
Wszehniczy Piastowskiej 3, 61-614 Poznań, Poland*

⁴*Institut des Molécules et Matériaux du Mans, IMMM UMR CNRS 6283,
Le Mans Université, F-72085 Le Mans, France*

⁵*Institute of Experimental Physics, Slovak Academy of Sciences,
Watsonova 47, 040 01 Košice, Slovakia*

A highly tunable magnetocaloric effect was observed in melt-spun amorphous $\text{Gd}_{65}\text{Fe}_{15-x}\text{Co}_{5+x}\text{Al}_{10}\text{Si}_5$ ($x = 0, 5, 10$) alloys with different Fe/Co ratios. Their magnetic properties were compared with those of previously investigated “parent” $\text{Gd}_{65}\text{Fe}_{10}\text{Co}_{10}\text{Al}_{15}$ alloy. The glassy structure of the melt-spun samples was confirmed by X-ray diffraction (XRD) and ^{57}Fe Mössbauer spectrometry. Their Curie temperatures (T_C) were between 155 and 195 K and significantly increased with decreasing Co content. The highest value of the magnetic entropy change $\Delta S_M = 6.8$ J/kg K was obtained for $\text{Gd}_{65}\text{Fe}_5\text{Co}_{15}\text{Al}_{10}\text{Si}_5$, when the magnetic field was changed from 0 to 5 T. Refrigerant capacity (RC) takes values close to 700 J/kg for the whole series of alloys. The occurrence of the second order phase transition and the conformity of the magnetic behavior with the mean field model were discussed on the basis of the analysis of the universal curves and the values of the exponent n .