Tuning the magnetocaloric response in Gd-rich amorphous alloys

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A highly tunable magnetocaloric effect was observed in melt-spun amorphous Gd₆₅Fe₁₅₋ₓCo₅₊ₓAl₁₀Si₅ (x = 0, 5, 10) alloys with different Fe/Co ratios. Their magnetic properties were compared with those of previously investigated “parent” Gd₆₅Fe₁₀Co₁₀Al₁₅ alloy. The glassy structure of the melt-spun samples was confirmed by X-ray diffraction (XRD) and ⁵⁷Fe Mössbauer spectrometry. Their Curie temperatures (Tₐ) were between 155 and 195 K and significantly increased with decreasing Co content. The highest value of the magnetic entropy change ΔSₘ = 6.8 J/kg K was obtained for Gd₆₅Fe₅Co₁₅Al₁₀Si₅, 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.