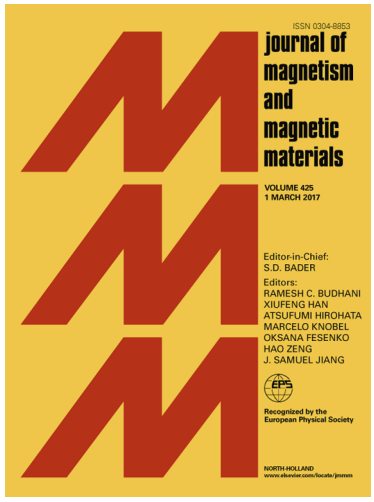

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The effect of Co substitution on the magnetic and magnetocaloric properties of Gd_3Ru

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Abstract

The effects of Co substitution on the structure, magnetic properties, and magnetocaloric effect of $Gd_3Ru_{1-x}Co_x$ ($0.05 \le x \le 0.20$) alloys have been investigated by X-ray diffraction and magnetization measurements. The Curie temperatures varied between 60 K and 92 K with Co substitution for Ru. With an applied magnetic field change (ΔH) of 50 kOe, the maximum values of magnetic entropy change ($-\Delta S_M$) were determined to be 25.8, 23.1, 19.4, and 10.8 J/kg K for compositions with x = 0.05, 0.10, 0.15, and 0.20, respectively. The corresponding refrigeration capacities (*RCs*) for the alloys were reasonably large and calculated to be 495, 475, 467, and 517 J/kg. The magnetic phase transitions in the $Gd_3Ru_{1-x}Co_x$ ($0.05 \le x \le 0.15$) alloys are of first-order. In the $Gd_3Ru_{0.80}Co_{0.20}$, the first-order magnetic phase transition disappears and the transition is broadened hence it increases in *RC*. The high $-\Delta S_M$ values and accompanying large *RC*s for the $Gd_3Ru_{1-x}Co_x$ ($0.05 \le x \le 0.20$) alloys qualify them as potential candidates for magnetic refrigeration applications near liquid nitrogen temperature.

Keywords: magnetocaloric effect; magnetic entropy change; first-order magnetic phase transition

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