

Accepted Manuscript

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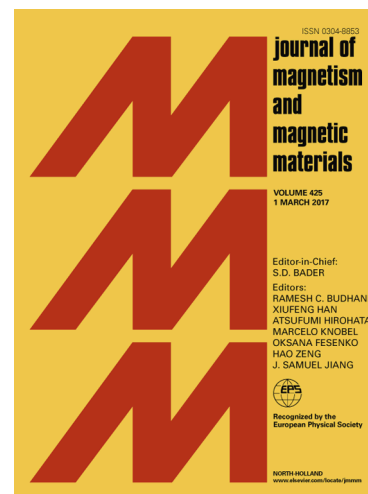
PII: S0304-8853(17)31786-9
DOI: <https://doi.org/10.1016/j.jmmm.2017.09.052>
Reference: MAGMA 63182

To appear in: *Journal of Magnetism and Magnetic Materials*

Received Date: 10 June 2017
Revised Date: 22 August 2017
Accepted Date: 20 September 2017

Please cite this article as: Y.F. Shang, Y.T. Cao, E. Agurgo Balfour, H. Fu, X.C. Zhong, A.A. El-Gendy, R.L. Hadimani, Y. Luo, The effect of Co substitution on the magnetic and magnetocaloric properties of Gd_3Ru , *Journal of Magnetism and Magnetic Materials* (2017), doi: <https://doi.org/10.1016/j.jmmm.2017.09.052>

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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 $\text{Gd}_3\text{Ru}_{1-x}\text{Co}_x$ ($0.05 \leq x \leq 0.20$) 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 (RC s) for the alloys were reasonably large and calculated to be 495, 475, 467, and 517 J/kg. The magnetic phase transitions in the $\text{Gd}_3\text{Ru}_{1-x}\text{Co}_x$ ($0.05 \leq x \leq 0.15$) alloys are of first-order. In the $\text{Gd}_3\text{Ru}_{0.80}\text{Co}_{0.20}$, 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 $\text{Gd}_3\text{Ru}_{1-x}\text{Co}_x$ ($0.05 \leq x \leq 0.20$) 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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