Effect of extra nonmagnetic Ga atoms on lattice ordering and magnetic properties of Fe$_2$CoGa and Co$_2$FeGa Heusler compounds

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Abstract
Arc-melting with ball milling was used for preparing Fe$_2$CoGa$_{1+x}$ and Co$_2$FeGa$_{1+x}$ ($x=0,0.2$) Heusler samples. Effect of extra nonmagnetic Ga atoms on lattice ordering and magnetic properties of Fe$_2$CoGa and Co$_2$FeGa Heusler compounds was studied. Rietveld refinement showed that lattice parameter of the samples increases in the presence of extra Ga atoms. Results showed that Co$_2$FeGa$_{1.2}$ has a partial lattice disordering. Saturation magnetization of Co$_2$FeGa sample was lower than Slater – Paulig prediction due to the crystallite size on a scale of nanometer. Reduction of saturation magnetization by increasing Ga atoms was explained through the change of lattice parameter, lattice ordering, and crystallite size. Saturation magnetization of Fe$_2$CoGa sample was greater than Slater – Paulig value. Change of lattice parameter by increasing Ga atoms resulted a decrease of saturation magnetization in Fe$_2$CoGa$_{1.2}$.

Keywords: Heusler alloys, magnetic properties, lattice ordering, Rietveld refinement

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