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Martensitic phase transitions in Ni2-xCrxMnGa Heusler alloys

ABDUL QUADER, DR¿ MAHMUD KHAN, Miami Univ — The coupled first order magneto-crystalline transformation exhibited by ferromagnetic materials is of significant interest. The martensitic phase transformation is one such transition that is often observed in intermetallic alloys like Ni2MnGa. The material has been extensively studied for many years and it has been shown that the ferromagnetic transition temperature, TC, and the martensitic transformation temperature, TM, in this material can be precisely controlled by manipulating the stoichiometry and/or by atomic doping. In one such recent study it was shown that the partial replacement of Mn by Cr in Ni2Mn1-xCrxGa, caused an increase of TM and decrease of TC in the system. The most notable behavior was detected in the resistivity data of the materials, in the vicinity of TM, step-like drop was observed in the resistivity data and the magnitude of the drop increased dramatically with increasing Cr concentration. Considering this atypical behavior in the resistivity data of Ni2Mn1-xCrxGa system, it is interesting to investigate the transport properties of Ni2-xCrxMnGa system, where Ni (instead of Mn) is partially replaced with Cr. Therefore, we have investigated a series of Ni2-xCrxMnGa compounds by x-ray diffraction, dc magnetization, and electrical resistivity measurements. The goal was to explore the change in the nature of the martensitic transformation in the alloys caused by the Cr doping. The results show, TM decreases while TC increases with increasing Cr concentration. For x >0.2, no martensitic transformation is observed in the materials. Interestingly, the sharp step-like drops observed in the resistivity of the Ni2Mn1-xCrxGa system was not observed in the Ni2-xCrxMnGa materials. The experimental results are discussed considering the intrinsic disorder and associated electronic structure of the system. .

Abdul Quader
Miami Univ

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