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Structural, Magnetic and Electron Transport Properties of Rapidly Quenched CoFeCrAl Nanostructures[1] P. KHAREL, R. FUGLSBY, S. GILBERT, Y. HUH, Department of Physics, South Dakota State University, W. ZHANG, Nebraska Center for Materials and Nanosceince and Department of Physics and Astronomy, University of Nebraska, S. VALLOPPILLY, Nebraska Center for Materials and Nanosceince, University of Nebraska, R. SKOMSKI, D.J. SELLMYER, Nebraska Center for Materials and Nanosceince and Department of Physics and Astronomy, University of Nebraska — Materials with moderate magnetization, high spin polarization at the Fermi level and high Curie temperature well above room temperature have huge potential for spin-based electronic devices. Several Heusler compounds including a quaternary compound CoFeCrAl are predicted to have these interesting materials properties. We have used a rapid quenching technique to prepare single-phase CoFeCrAl nanostructured ribbons in a cubic L21 crystal structure and have investigated the magnetic and electrical properties. As-quenched ribbons are ferrimagnetic at room temperature with a Curie temperature of about 500 K. The saturation magnetization is 1.9 μ_B/f.u, which is very close to the value predicted by the Slater-Pauling Rule. The ribbons are conducting with a room temperature resistivity of about 80 mΩcm, but the resistivity is almost independent of temperature. The thermal coefficient of resistivity is very small and it is negative. These ribbons show a small positive magnetoresistance (1.5% at 5 K) between 5 K and 300 K. We will also discuss the effect of vacuum annealing on the structural and magnetic properties of this material.

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P. Kharel
Department of Physics, South Dakota State University

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