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Anomalous Hall Effect and Anomalous Nernst Effect in Ga1-xMnxAs YONG PU, JING SHI, Department of Physics, University of California-Riverside, DAICHI CHIBA, FUMIHIRO MATSUKURA, HIDEO OHNO, RIEC, Tohoku University, Japan — We have carried out systematic electrical and thermoelectric transport coefficient measurements on a series of Ga1-xMnxAs samples (x from 0.01 to 0.07) with perpendicular magnetic anisotropy. 50 nm- thick Ga1-xMnxAs films were grown by molecular beam epitaxy on an InGaAs buffer layer with a tensile strain to induce the perpendicular anisotropy. Below the Curie temperature, we have observed a non-zero transverse thermopower Sxy that accompanies the Hall resistance Rxy. Both Sxy and Rxy show abrupt jumps as the magnetization switches by an external magnetic field. The square hysteresis loops in Sxy and Rxy resemble those of the magnetization. Just as the anomalous Hall effect (AHE), the hysteresis loop in Sxy, i.e. the anomalous Nernst effect (ANE), is a consequence of the spin-orbit coupling in the ferromagnetic materials. We have measured both AHE and ANE over a wide range of temperatures in all samples, and found that the Hall resistance Rxy scales with the square of the longitudinal resistance Rxx. In contrast, the transverse thermopower Sxy is independent of the longitudinal thermopower Sxx over the same temperature range. These observations suggest that both AHE and ANE are of intrinsic or dissipationaless origin.

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