
Materials Research Science and Engineering Center
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Magnetic Susceptibility Studies

Interesting behavior is observed when a ferromagnetic material is coated with an antiferromagnetic material, and then cooled in an external magnetic field. Meiklejohn and Bean [1] observed that Cobalt particles prepared this way showed a preferential alignment of the sample magnetization along a single direction. This is called the Ferromagnetic/Antiferromagnetic Exchange Bias effect or the Exchange Anisotropy effect. This effect, if understood, may lead to improved magnetic sensors and memory devices.

Magnetic susceptibility measures how easily a sample is affected by a magnetic field. In alternating current (AC) susceptibility measurements, a time-varying magnetic field, H_{ac} , is used. The ac magnetic susceptibility of a sample is given by dM/dH_{ac} , where M is the magnetization (magnetic moment per unit volume) of the sample. When relatively small magnetic fields are used, susceptibility measurements are reversible (the sample is not changed from its original state by the measuring process). Magnetic susceptibility measurements [2] can be used to gain additional insight into the exchange bias effect. Last year, using funds provided by the MRSEC summer research program, an ac susceptometer was constructed. We propose to improve the capabilities of the device and use it to study the exchange bias effect in thin film samples of Co/CoO and other materials.

Footnotes

1. W. H. Meiklejohn and C. P. Bean, *Physical Review*, vol. 102, p. 1413 (1956) and vol. 105, p. 904 (1957).
2. V. Strom, B. J. Jonsson, K.V. Rao, and Dan Dahlberg, *Journal of Applied Physics*, vol. 81, p. 5003 (1997).