U.S. Department of Commerce
Juanita M. Kreps
Secretary

National Bureau of Standards
Ernest Ambler, Director

National Bureau of Standards

Certificate

Standard Reference Material 772

Magnetic Moment Standard

Nickel Sphere

R. E. Mundy and G. A. Candela

For this nickel sample the specific magnetic moment, σ, in $Oe \cdot cm^3 \cdot g^{-1}$ is given as a function of the applied magnetic field, H in oersteds (Oe), by the expression:

$$\sigma = 54.95\left(1 - \frac{12.0}{H}\right).$$

The specific magnetic moment is the magnetization [1] divided by the density. Between 3500 and 10000 oersteds the moment values are estimated to be accurate within ±0.4 percent with a precision of ±0.1 percent.

The following is a tabulation of the specific magnetic moment at four field strengths:

H, Oe	σ, $Oe \cdot cm^3 \cdot g^{-1}$
3500	54.75
4500	54.80
6500	54.85
10000	54.90

The nickel moment values are given for a temperature of 298 K. The values vary with a negative temperature dependence of 0.03% per degree K at room temperature.

The specific magnetic moment in SI units ($A \cdot m^2 \cdot kg^{-1}$) [1] is given by the expression:

$$\sigma = 54.95\left(1 - \frac{960}{H}\right),$$

where H is given in amperes per meter. Note that the numerical values of the specific magnetic moment are the same in both systems of units.

Washington, D.C. 20234
October 18, 1978

J. Paul Cali, Chief
Office of Standard Reference Materials

(Over)

The intrinsic induction, B_i in gauses, was calculated using the literature value of 8.907 g/cm^3 for the density of nickel [2]. The intrinsic induction is given by the expression:

$$B_i = 6150\left(1 - \frac{12.0}{H}\right).$$

In SI units the intrinsic induction in teslas is given by the expression:

$$B_i = 0.6150\left(1 - \frac{960}{H}\right).$$

The technical and support aspects involved in the preparation, certification, and issuance of this SRM were coordinated through the Office of Standard Reference Materials by R. K. Kirby.

Supplementary Information

This SRM was prepared from nickel metal of 99.999 percent purity. The nickel was ground into 2.4 mm nominal diameter spheres. These spheres were cleaned, annealed in a hydrogen atmosphere for two hours at 1220 K, cooled slowly, and given a final light etch with a solution of 1:1 NaOH and H_2O_2. The specific magnetic moment values of the nickel spheres were then determined by an absolute gradient force method developed at NBS. A detailed account of the method and procedures used in certifying this SRM will be described at a later date in the "260 series" of NBS Special Publications.

The SRM should be handled with nonferrous instruments such as brass or plastic forceps, and contact with any ferromagnetic materials should be avoided. If the sample is work hardened by being ground, cut, etc., then the above expressions for the magnetic moment will not hold. The sample weight must be determined by the user.

[1] L. H. Bennett, C. H. Page, and L. J. Swartzendruber; "Comments on Units in Magnetism"; J. Res. Nat. Bur. Sta., **83**(1), 9 (Jan-Feb, 1978).

[2] NBS Circular 539, Standard X-Ray Diffraction Powder Patterns, Volume 1, p. 13, (1953).