National Institute of Standards & Technology

Certificate of Analysis

Standard Reference Material® 3113

Spectrometric Standard Solution

Cobalt

Batch Code 692904

This Standard Reference Material (SRM) is intended for use in atomic absorption spectrometry, inductively coupled plasma spectrometry, spectrophotometry, or any other analytical technique that requires aqueous standard solutions for calibrating instruments. SRM 3113 is a single element solution prepared gravimetrically to contain a nominal 10 mg/mL of cobalt with an approximate nitric acid volume fraction of 10 %. The certified value (Y) is based on the mass of high-purity metal dissolved and diluted to known volume. The value has been adjusted upward by 0.1 % relative, based on estimated transpiration losses of solvent through the container walls of 0.2 % relative per year. The density of the solution at 22 °C is 1.047 g/mL.

Metal	Concentration (Y) (mg/mL)	Source Purity, %	Acid Volume Fraction, Approximate
Cobalt	10.00 ± 0.03	Co metal, (99.99)*	HNO_3, 10 %

*This high-purity material was analyzed for gaseous constituents using inert gas fusion for oxygen and nitrogen, and vacuum extraction for hydrogen. The metallic impurity levels were determined by inductively coupled plasma mass spectrometry. The metal was found to contain 101 mg/kg of dissolved gases and less than 20 mg/kg metallic impurities.

The uncertainty in the certified value is calculated as

$$U = (2u_c + 0.001Y) \text{ mg/mL}$$

where u_c is the "combined uncertainty" calculated according to the ISO Guide [1]. The value u_c is intended to represent, at the level of one standard deviation, the combined effect of uncertainty components associated with volumetric and gravimetric factors, as well as the purity of the starting material. The additional quantity, $0.001Y$, is an allowance for transpiration of the solution through the container walls, which is estimated to be ± 0.1 % of the certified value during the one-year period of validity of the certification.

The combined uncertainty consists of a Type A component associated with replicate weighings of the starting material and Type B components due to uncertainty in the material purity, material handling, and dilution.

SRM 3113 was prepared and analyzed using atomic absorption spectrometry by T.A. Butler of the NIST Analytical Chemistry Division. Inductively coupled plasma mass spectrometric analysis of the starting material was performed by G.C. Turk of the NIST Analytical Chemistry Division. Gas analysis of the starting material was performed at Luvak, Inc., Boyleston, MA.

The support aspects involved in the preparation, certification, and issuance of this SRM were coordinated through the Standard Reference Materials Program by B.S. MacDonald.

Gaithersburg, MD 20899
May 15, 1996

Thomas E. Gills, Chief
Standard Reference Materials Program

Procedures for Use

Stability: This certification is valid for one year from the shipping date, provided the solution is kept tightly capped and stored under normal laboratory conditions. NIST will monitor the stability of representative solutions from this SRM lot, and if any changes occur that invalidate this certification, NIST will notify purchasers.

Preparation of Working Standard Solutions: All solutions should be brought to 22 °C ± 1 °C before use and all glass or plastic surfaces coming into contact with the standard must have been previously cleaned. A working standard solution can be prepared from the SRM solution by serial dilution. Dilutions should be made with certified volumetric class A flasks and 5 mL or 10 mL class A pipets. All volumetric transfers of solutions should be performed using a proven analytical technique. Each dilution should be acidified with an appropriate high-purity acid and diluted to calibrated volume using high-purity water. The stability of the working standard solution will depend on the final acid concentration; therefore, care should be exercised to ensure that the final acid concentration of the dilution closely approximates that of the SRM. The analyst should prepare daily working solutions from 100 μg/mL dilutions of the original SRM solution.

NOTICE AND WARNING TO USERS

For some instrumental techniques, small differences in acid type and concentration between the SRM and sample may lead to erroneous results. Therefore, the same acid mixture as is listed on this SRM certificate should be used in making appropriate dilutions and working standards.

REFERENCE

[1] *Guide to the Expression of Uncertainty in Measurement,* ISBN 92-67-10188-9, 1st Ed. ISO, Geneva, Switzerland, (1993): see also Taylor, B.N. and Kuyatt, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results," NIST Technical Note 1297, (1994).