National Institute of Standards & Technology

Certificate of Analysis

Standard Reference Material® 3116a

Spectrometric Standard Solution

Erbium

Batch Code 691906

This Standard Reference Material (SRM) is intended primarily for use in calibrating instruments used in atomic spectrometry, including atomic absorption spectrometry, inductively coupled plasma optical spectrometry, and inductively coupled plasma mass spectrometry. It can also be used in conjunction with any other analytical technique or procedure where an aqueous standard solution is required. One unit of SRM 3116a consists of 50 mL of a single element solution prepared gravimetrically to contain a known amount of erbium in an approximate nitric acid volume fraction of 10 %.

The certified value (Y) is based on replicate titrations against a reference solution of erbium metal of known purity. The base material for this SRM was analyzed for gaseous constituents using inert gas fusion for oxygen and nitrogen, and vacuum extraction for hydrogen. Other elemental impurity levels were determined by inductively coupled plasma mass spectrometry. 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 is 1.058 g/mL $\pm$ 0.002 g/mL at 22 °C.

Certified Value (Y) of Erbium: 9.988 mg/mL $\pm$ 0.014 mg/mL at 22 °C

The uncertainty in the certified value is calculated as

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

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, titrimetric 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 $\pm$ 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 titrations of the starting material and Type B components due to uncertainty in the material purity, material handling, and dilution.

This SRM was prepared gravimetrically and analyzed using atomic absorption spectrometry by T.A. Butler of the NIST Analytical Chemistry Division. Titrimetric analyses were performed by J. Smeller and T.W. Vetter of the NIST Analytical Chemistry Division. Analysis of the starting material was performed using optical emission spectrometry by J.A. Norris of the NIST Analytical Chemistry Division.

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
Certificate Issue Date: September 10, 1996

Thomas E. Gills, Chief
Standard Reference Materials Program

Procedures for Use

Expiration of Certification: 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 in contact with the standard must have been previously cleaned. A working standard solution can be prepared from the SRM solution by serial dilution. Each dilution should be acidified with an appropriate high purity acid in high purity water. The analyst should prepare daily working solutions from 100 μg/mL dilutions of the original SRM solution.

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).