

National Bureau of Standards

Certificate

Standard Reference Material 2034

Holmium Oxide Solution Wavelength Standard

From 240 to 650 nm

This Standard Reference Material (SRM) is intended as a reference material for establishing the accuracy of the wavelength scale of conventional spectrophotometers in the spectral range 240 to 650 nm. It consists of a solution of 4 percent holmium oxide in 10 percent perchloric acid in water, sealed in a nonfluorescent fused silica cuvette of nominal 10 mm light path. (The cuvette fits most conventional spectrophotometers; see note 1.) The cuvette should be handled only by the tubular end, and, while not in use it should be stored in the container provided. The certified wavelengths of minimum transmittance, expressed in nanometers, are given in Table 1 for six spectral bandwidths from 0.1 to 3.0 nm for 14 bands. They are illustrated in Figure 1. The estimated uncertainty of the measured minimum transmittance wavelengths is believed to be no greater than ± 0.1 nm at the measurement temperature of $25^\circ\text{C} \pm 5^\circ\text{C}$, and includes the random and systematic errors of the measuring procedure. For details concerning the materials, instrumentation, and method used in the certification of SRM 2034 the user is referred to NBS Special Publication 260-102. This Special Publication also describes the influence of purity and concentration of the holmium oxide solution and temperature, and describes the procedure used for assessment of the wavelengths of minimum transmittance and the establishment of the accuracy of the wavelength scale of the spectrometer used.

The initial research at NBS concerning the potential use of the $\text{Ho}_2\text{O}_3 - \text{HClO}_4$ solution as a wavelength standard was performed by K.D. Mielenz and R.A. Velapoldi.

The transmittance measurements given in this certificate and investigations on the various chemical and physical parameters that might influence the results were performed by V.R. Weidner and R. Mavrodineanu.

The overall direction and coordination of the technical measurements leading to certification were performed under the chairmanship of K.D. Mielenz, NBS Radiometric Physics Division, Center for Radiation Research.

The technical and support aspects involved in the issuance of this Standard Reference Material were coordinated through the Office of Standard Reference Materials by R.L. McKenzie and L.J. Powell.

Gaithersburg, MD 20899
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Stanley D. Rasberry, Chief
Office of Standard Reference Materials

(over)

CAUTION:

If the cuvette of SRM 2034, which contains holmium oxide as well as perchloric acid, is accidentally broken, the following action should be taken:

“Perchloric acid spills should be diluted immediately with water, taken up with swabs (preferably wool) and then washed with generous amounts of water. The swabs should also be washed with water before discarding. Swabs of cotton or other cellulose material contaminated with perchloric acid should be regarded as fire or explosion hazards if not washed thoroughly with large amounts of water” (1,2).

References:

- (1) Schilt, Alfred A., Perchloric Acid and Perchlorates, the G. Frederick Smith Chemical Co., Publisher, 867 McKinley Ave., Columbus, Ohio 43223, pg. 157 (1979).
- (2) Schumacher, Joseph C., Perchlorates, Their Properties, Manufacture and Use, Reinhold Publishing Corp., NY: Chapman & Hall, LTD, London, pg. 187 (1960).

NOTES:

- (1) If the cuvette is too tall for the sample compartment of the spectrophotometer, a piece of black opaque cloth can be used to provide a temporary lightproof enclosure.
- (2) The cuvettes have been individually tested for leaks. Should a leak subsequently develop, follow the procedure recommended above (under “CAUTION”).

Table 1

Wavelengths of Minimum Transmittance at Six Spectral Bandwidths for a 4 Percent Holmium Oxide Solution in 10 Percent Perchloric Acid in Water.

Minimum Transmittance Band No.	Spectral Bandwidths (nm)					
	<u>0.1</u>	<u>0.25</u>	<u>0.5</u>	<u>1</u>	<u>2</u>	<u>3</u>
1	240.99	240.97	241.01	241.13	241.08	240.90
2	249.83	249.78	249.79	249.87	249.98	249.92
3	278.15	278.14	278.13	278.10	278.03	278.03
4	287.01	287.00	287.01	287.18	287.47	287.47
5	333.47	333.44	333.43	333.44	333.40	333.32
6	345.55	345.55	345.52	345.47	345.49	345.49
7	361.36	361.35	361.33	361.31	361.16	361.04
8	385.45	385.42	385.50	385.66	385.86	386.01
9	416.07	416.07	416.09	416.28	416.62	416.84
10	-----	-----	-----	451.30	451.30	451.24
11	467.82	467.82	467.80	467.83	467.94	468.07
12	485.28	485.28	485.27	485.29	485.33	485.21
13	536.54	536.53	536.54	536.64	536.97	537.19
14	640.51	640.49	640.49	640.52	640.84	641.05

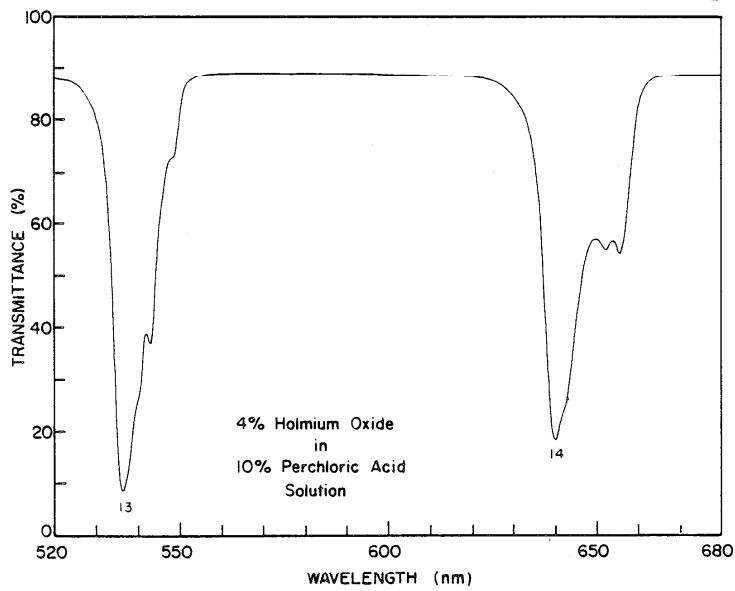
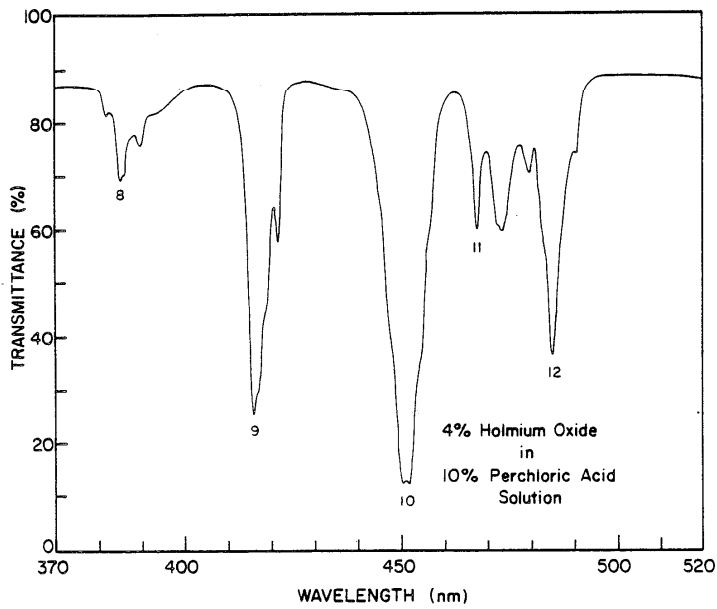
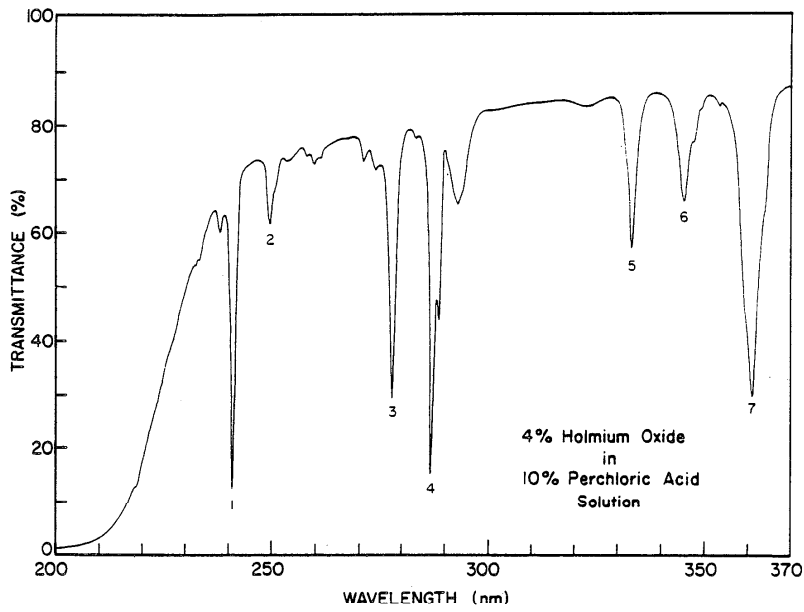


Figure 1-Spectral transmittance of a 4% solution of holmium oxide in 10% perchloric acid in water.