

National Bureau of Standards

Certificate

Standard Reference Material 2003b

First Surface Aluminum Mirror for Specular Reflectance from 250 to 2500 nm

V. R. Weidner and J. J. Hsia

This Standard Reference Material (SRM) is intended for use in calibrating the photometric scale of specular reflectometers. SRM 2003b is 5.1 cm in diameter and 0.95 cm thick onto which aluminum has been vacuum deposited. Each SRM was aged one year before calibration. No other protective coatings were applied to the mirror.

The specular reflectance of each mirror was measured on a high-precision reflectometer for 6° incidence at 25-nm intervals from 250 to 400 nm, 50-nm intervals from 400 to 1000 nm, 100-nm intervals from 1000 to 1300 nm, and 250 nm intervals from 1500 to 2500 nm. In addition to these wavelengths, the reflectance was measured at the laser wavelengths of 632.8 and 1060 nm.

The high-precision reflectometer was calibrated with a master mirror which had previously been measured with a highly accurate spectrophotometer with a specular reflectometer attachment. The reflectance of the master mirror was measured at the above specified wavelengths and at angles of incidence of 6°, 30°, and 45°. These measurements were made for both vertically and horizontally polarized incident beams. The overall uncertainty of these measurements is ± 0.002 .

The specular reflectance of the SRM 2003b was measured relative to the master mirror at 6° incidence only. No differences were detected between the reflectance values for the master mirror and the SRM mirrors. Thus, the certified values of specular reflectance for the SRM mirrors are the average reflectance values of the vertical and horizontal polarizations for the master mirror at 6° incidence. The certified values are listed in Table 1 and have an uncertainty of ± 0.005 .

Table 2 lists the reflectance data for the master mirror. These data are not certified for SRM 2003b, but are provided to show the variation in specular reflectance of a typical first surface mirror as a function of angle of incidence and plane of polarization.

Figure 1 shows the spectral distribution of a typical first surface aluminum mirror. The wavelength scale of this plot is greatly compressed and the reflectance scale is expanded to emphasize the absorption features. Note that the absorption band at 800 nm is an inherent characteristic of aluminum mirrors.

CAUTION: SRM 2003b cannot be cleaned without adversely affecting the aluminum coating. Therefore the mirror must be handled carefully so that nothing touches the aluminum surface. When not in use, the mirror should be stored in its container.

This Standard Reference Material was calibrated in the Radiometric Physics Division of the Center for Radiation Research.

The technical and support aspects involved in the certification and issuance of this SRM were coordinated through the Office of Standard Reference Materials by R.W. Seward.

Washington, DC 20234
March 19, 1984

Stanley D. Rasberry, Chief
Office of Standard Reference Materials

Table 1
First Surface Aluminum Mirror
(6° Incidence)

<u>Wavelength (nm)</u>	<u>Reflectance</u>
250	0.905
275	.912
300	.915
325	.917
350	.918
375	.919
400	.919
450	.918
500	.915
550	.912
600	.907
632.8	.903
650	.901
700	.892
750	.878
800	.858
850	.854
900	.889
950	.919
1000	.937
1060	.948
1100	.953
1200	.959
1300	.963
1500	.967
1750	.968
2000	.969
2250	.969
2500	.969

Table 2

The spectral reflectance of a typical first surface aluminum mirror as a function of wavelength, angle of incidence, and polarization.

(These values are not certified)

Wavelength and Angle of Incidence	Parallel (p) Polarized	Perpendicular (s) Polarized	Unpolarized (ordinary)
<u>250 nm</u>			
6°	0.9043	0.9066	0.9054
30°	.8932	.9201	.9066
45°	.8782	.9345	.9063
<u>300 nm</u>			
6°	.9143	.9150	.9146
30°	.9042	.9277	.9159
45°	.8885	.9415	.9150
<u>400 nm</u>			
6°	.9185	.9189	.9187
30°	.9081	.9302	.9192
45°	.8910	.9431	.9170
<u>600 nm</u>			
6°	.9067	.9074	.9070
30°	.8956	.9201	.9078
45°	.8753	.9351	.9052
<u>800 nm</u>			
6°	.8572	.8587	.8580
30°	.8390	.8768	.8579
45°	.8079	.8986	.8533
<u>1000 nm</u>			
6°	.9362	.9374	.9368
30°	.9309	.9473	.9391
45°	.9171	.9570	.9371
<u>1500 nm</u>			
6°	.9662	.9669	.9666
30°	.9661	.9740	.9701
45°	.9606	.9799	.9702
<u>2000 nm</u>			
6°	.9687	.9692	.9689
30°	.9694	.9764	.9729
45°	.9655	.9824	.9739
<u>2500 nm</u>			
6°	.9666	.9710	.9688
30°	.9715	.9762	.9738
45°	.9679	.9828	.9753

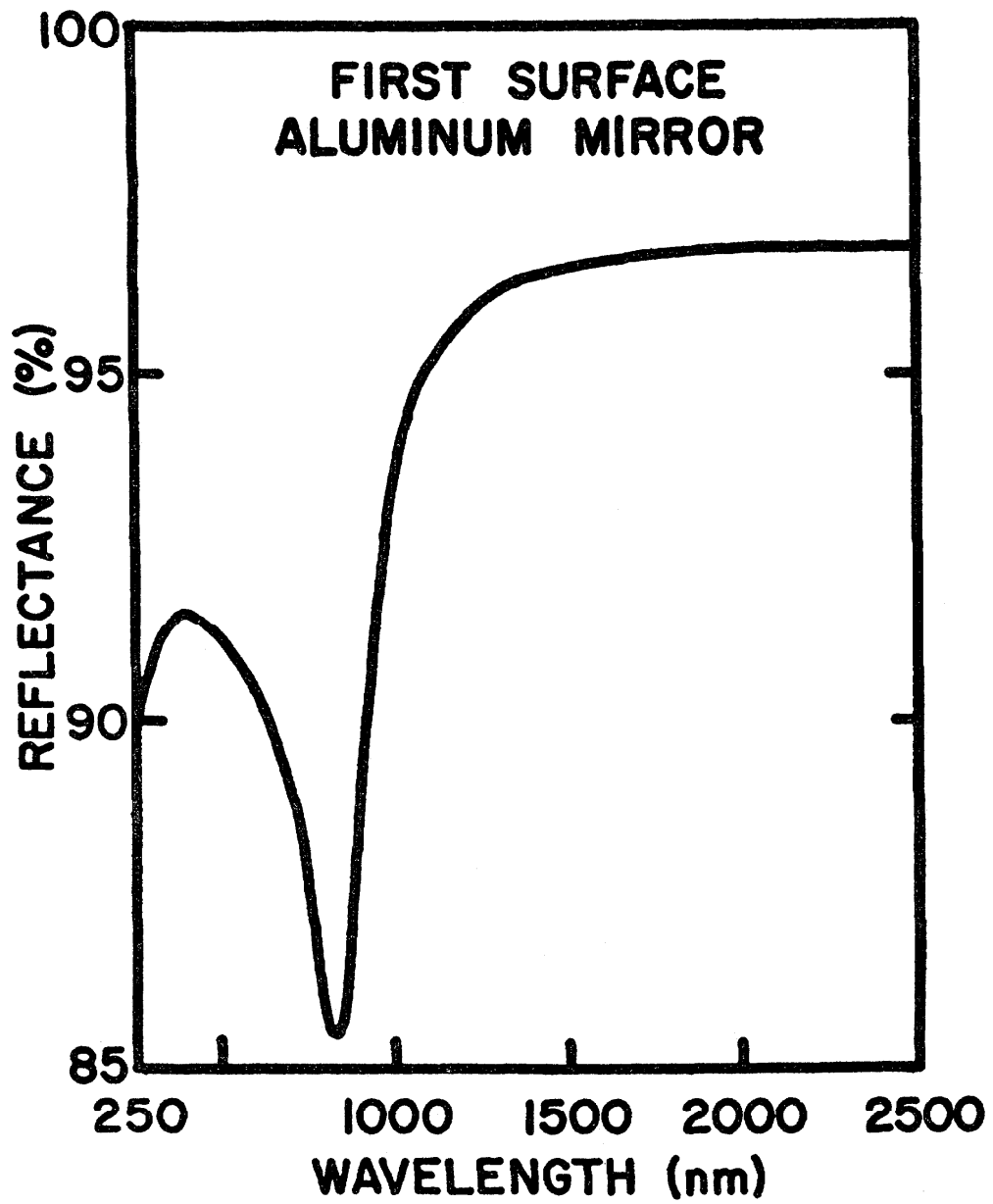


Figure 1. Typical spectral reflectance curve of the SRM 2003b first surface aluminum mirrors.