

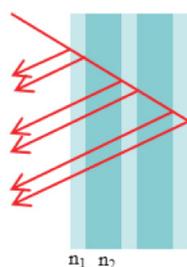
Absolute Reflectance Measurement of a Highly Reflective Material

Introduction

Dielectric multilayer mirrors are laminated optics comprising of a combination of high refractive index and low refractive index materials. Using the interference effect, this mirror can provide extremely high reflectance (near 100%) in a specific wavelength range (Figure 1). Since these mirrors are widely used in cameras, telescopes, and optical communications devices to reduce the loss in light intensity, it is important to evaluate the material's reflectance with very high accuracy.



V-750
UV-Visible Spectrophotometer



n_1 : high refractive index
 n_2 : low refractive index

Figure 1. Schematic of the dielectric multilayer mirror.

The absolute reflectance measurement system and the V-700 Series UV-Visible spectrophotometer provide high photometric stability for accurate measurements. The absolute reflectance system can perform measurements at arbitrary and user-selected incident angles, allowing the measurement of dielectric multilayer mirrors at specific incident angles.

This application note demonstrates the use absolute reflectance measurement system for obtaining highly reflective measurements for a dielectric multilayer mirror.

Keywords

V-750, UV-Visible/NIR, Absolute reflectance, Materials

Experimental

A dark measurement was performed with a light-shielding plate, the baseline measurement was performed against air, and then the sample measurement obtained. This procedure was repeated three times at the conditions listed below.

Measurement Conditions			
Bandwidth	5 nm	Response Time	3.84 seconds
Data Interval	1 nm	Scan Speed	20 nm/min
Incident Angle	10°	Polarization	p-polarized light

Results

Figure 2 shows an overlay of the absolute reflectance of the dielectric multilayer mirror and Figure 3 is a zoomed in view of the same spectra. The measurement repeatability of the system is very high and Table 1 compares the theoretical and measured reflectance values. The difference between the measurement average reflectance value and the theoretical value is greater than 0.15%, indicating that the absolute reflectance system has high accuracy and good correlation for reflectance measurements close to 100%R.

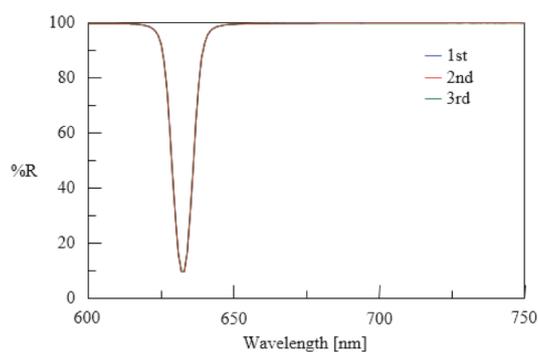


Figure 2. Absolute reflectance spectra of the dielectric multilayer mirror.

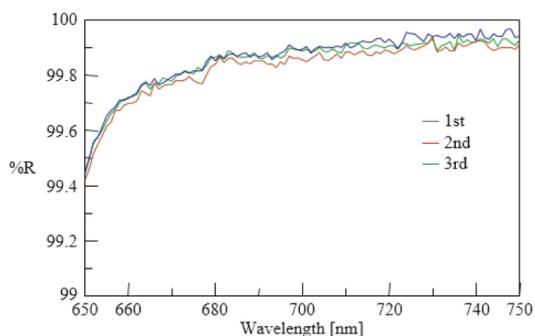


Figure 3. Absolute reflectance spectra of the dielectric multilayer mirror ~100%R.

Table 1. Comparison of theoretical and measured reflectance values.

Wavelength	Expected Value %R	Measurement Value %R			Average %R	Standard Variation	Variation Coefficient %	Difference Between Expected and Average
		1	2	3				
680	99.9914	99.8663	99.8537	99.8407	99.8536	0.013	0.013	-0.1378
700	99.9918	99.8892	99.8943	99.8578	99.8804	0.020	0.020	-0.1114
720	99.9839	99.9094	99.9316	99.8889	99.9100	0.021	0.021	-0.0739