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Application News

No. UV-023

Spectrophotometric Analysis

Thin Film Coating Comparison between the UV-2600 and SolidSpec-3700 UV-Vis-NIR Spectrophotometers

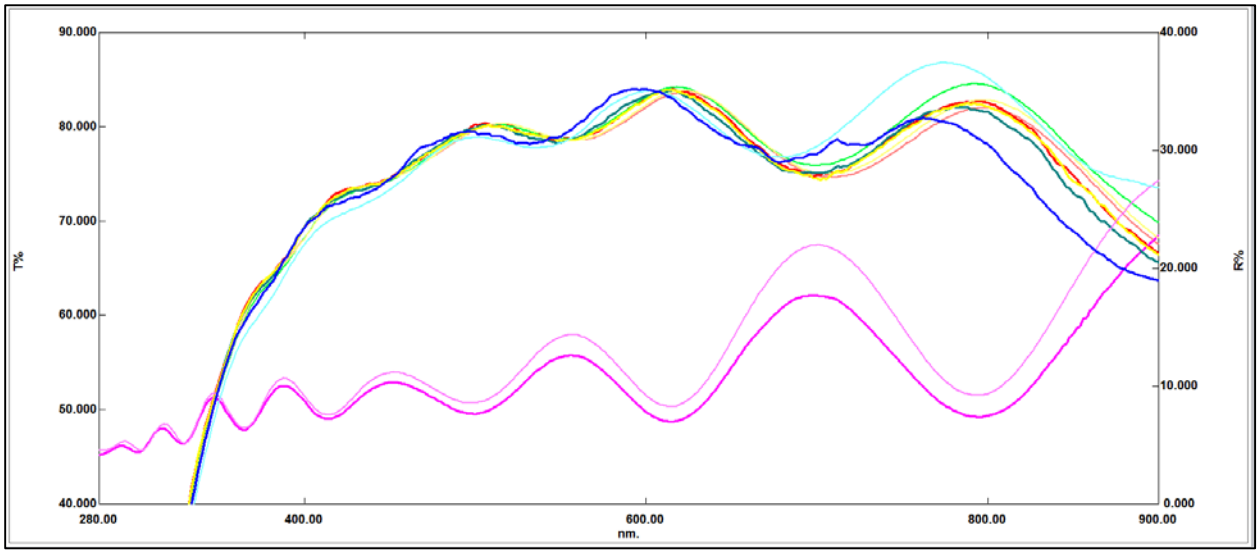
CM Talbott, Ph.D.

■ Introduction

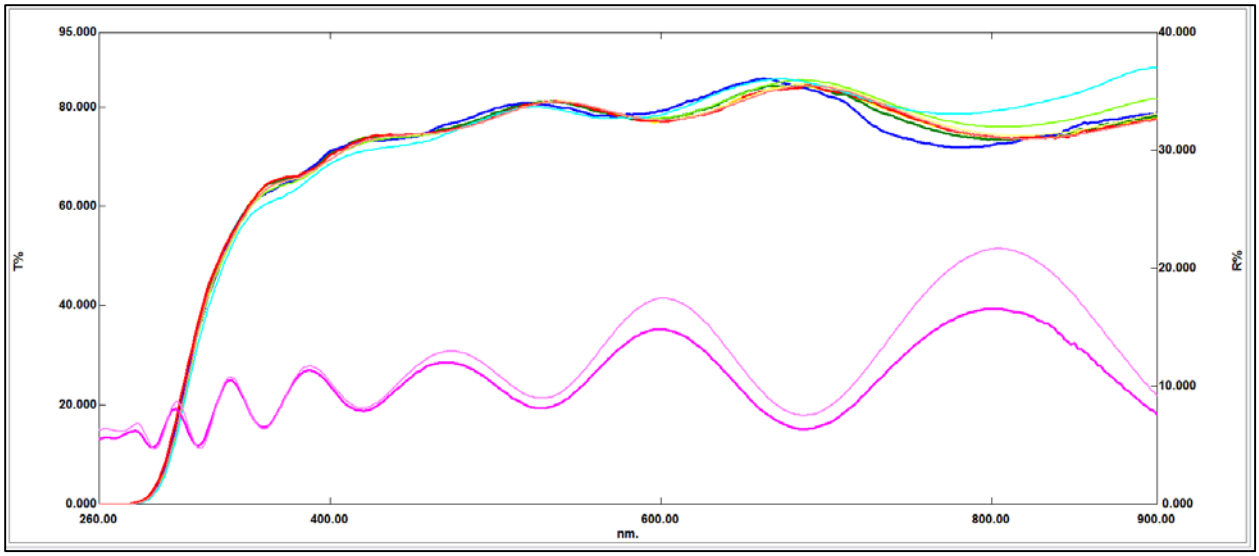
Many times the instrumentation between an R&D department and the production or QA/QC departments is different. Typically, R&D instrumentation has more features that provide more detail and variety in their ability to investigate samples, whereas typical QA/QC instrumentation may be more focused on their tasks. Often, the question of how spectra from one bench will compare to spectra of another bench is posed. To demonstrate the uniformity of the Shimadzu line of instrumentation, samples with thin film coatings were examined by reflection and transmission on the research-type SolidSpec-3700 and the QA/QC style UV-2600 UV-Vis-NIR spectrophotometers.

■ Experimental

Samples were analyzed for 5-degree reflectance, and transmittance at 0, 5, 15, and 30 degrees on both the UV-2600 and SolidSpec-3700 instruments. For each bench, the bandwidth was set to optimum for the measurements (5nm-UV-2600, 20nm-SS-3700) and the scan speeds were set to medium with a 2.0 nm sample pitch. On the UV-2600 spectrophotometer, the 5-degree specular reflectance accessory was used to acquire reflectance spectra and the Variable Incident Angle Film Holder was used to acquire transmission spectra. On the SolidSpec-3700, the Variable Angle Measurement Accessory (VAMA) was used to acquire both reflectance and transmittance spectra. Results for the two thin film-coated samples are shown below.



Sample 1; 5-deg reflectance (magenta), 0-deg trans (red), 5-deg trans (yellow), 15-deg trans (green), and 30 degree trans (blue), UV-2600 thin lines, SolidSpec-3700 thick lines.



Sample 1; 5-deg reflectance (magenta), 0-deg trans (red), 5-deg trans (yellow), 15-deg trans (green), and 30 degree trans (blue), UV-2600 thin lines, SolidSpec-3700 thick lines.

■ Results

The reflectance spectra for both samples (magenta in the graphs above) match very well between the two spectrophotometers and reflectance accessories. The difference in intensity at the higher wavelengths of these reflectance spectra can be attributed to the VAMA accessory's ability to measure absolute spectral reflectance whereas the 5-degree accessory can measure relative reflectance only. The difference in reflection at the higher wavelengths then are due to the spectral absorption for the mirror used to acquire the background with the 5-degree accessory.

The variable angle transmission spectra do show slight changes in the interference fringes of the transmitted light as the angle of incidence is changed from 0 degree normal to 30 degrees normal, as would be expected. Furthermore, in the transmission spectra, good correlation exists between the spectra acquired on the UV-2600 (thin lines) and those acquired on the SS-3700 (thick lines).

The above spectra show that good correlation exists between transmitted and reflected spectra acquisitions on different spectrophotometer benches. If film thickness was the desired result of the measurements, no changes would be observed between thicknesses measured on one bench over the other. Similarly, if the relative reflectance was corrected to absolute by the use of a standard, no reflectance differences nor transmission differences would be observed between the benches as well.

■ Conclusion

Shimadzu offers a wide range of UV-Vis-NIR spectrophotometers to meet all customer needs and budgets. This study has demonstrated that confidence can be had that there are no differences in spectral quality when samples are run on different instruments.

First Edition: September 2016

SHIMADZU Corporation
www.shimadzu.com/an/

SHIMADZU SCIENTIFIC INSTRUMENTS
7102 Riverwood Drive, Columbia, MD 21046, USA
Phone: 800-477-1227/410-381-1227, Fax: 410-381-1222
URL: www.ssi.shimadzu.com