

Application Note

UV VIS

Fields of Application / Industry:

- Chemistry / Polymer Industry
- Clinical Chemistry / Medicine / Hygiene / Health Care
- Cosmetics
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- Energy
- Environment / Water / Waste
- Food / Agriculture
- Geology / Mining
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- Pharmacy
- Refineries / Petrochemistry
- Semi-Conductor Technology
- Others

紫外吸收光谱法测定薄膜的吸收、透射和反射率

摘要:

在材料分析领域，样品的吸收率（光衰减内耗的百分率）、透射率（光穿过介质出去的百分率）和反射率（光反射出去的百分率）是很重要光学的参数，进而能分析材料的结构、厚度等物理性能。比如太阳镜、防晒化妆品以及防晒衣的UV 保护指数的测量，粉末样品漫反射的测量，镜片，薄片等透明材料的透过率的测量，膜厚度/涂层厚度的测量等。

本文利用德国耶拿公司 SPECORD 250 PLUS 紫外分光光度计，结合相应的附件，实现对材料特性参数的研究工作，完成对薄膜样品、固体样品以及粉末样品的相关参数的测定。并详细介绍采用积分球附件，进行材料吸光度，透过率，漫反射的测量；固体样品池架，对材料的吸光度和透过率进行测量；而可变角度反射附件可测量整个波长 200-1100nm、入射角度可在 11-60 度范围内灵活调节，对固体及粉末样品的反射率测定。

Determination of absorbance, transmittance and reflection of plastic foils

General

3 different foils with a thickness of 0,1 and 0,23mm have been analyzed. Determinations were performed with SPECORD® 250 PLUS by using different accessories. For absorbance and transmittance measurements a solid sample holder was used. The reflectance measurements were performed by using integrating sphere and reflectance attachment with variable angle. The sample was put into a solids holder for analysis.

Absorbance und transmittance measurement

Solid sample holder

Figure 1 shows the holder for solid samples. This accessory is suitable for solid samples with a diameter from 20mm and a thickness up to 25mm.



Fig. 1 Solid sample holder for SPECORD®

The measurements were carried out with the following parameter settings:

Title:	Absorbance/transmittance measurement	Measurement mode:	Scan mode
Correction:	Reference	Range:	200 -1100nm
Display:	Transmittance	Step width:	1nm
Lamp changeover:	320nm	Speed :	50nm/s
Slit:	2nm	Accessories:	none

The reference measurement was conducted against air. The sample was placed into the solid holder and fixed with the clip. The following curves show the absorbance (fig. 2) and transmittance (fig.3) of the foils.

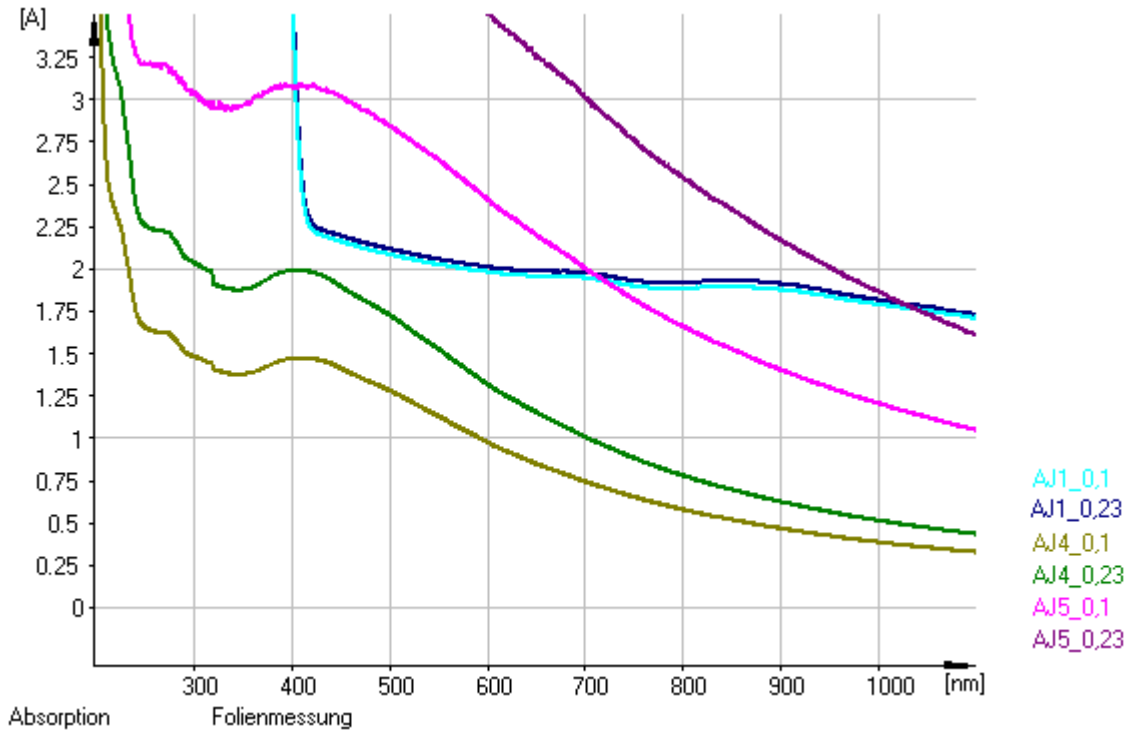


Fig. 2: Absorbance spectra of the foils

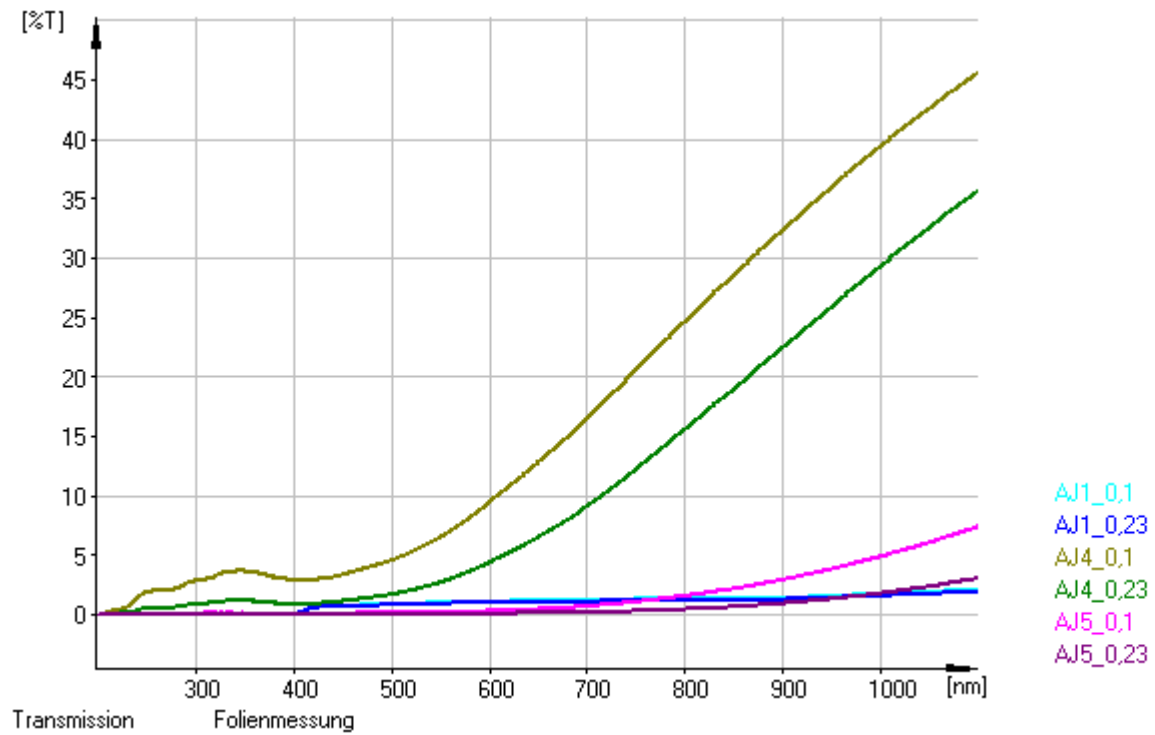
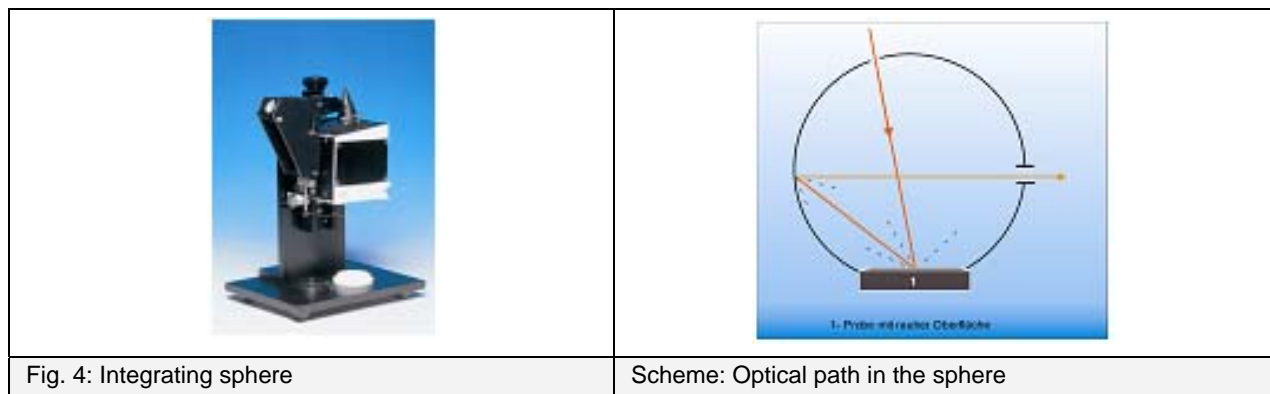


Fig. 3: Transmittance spectra of the foils

Reflectance measurements

a) Integrating sphere

The Ulbricht sphere (integrating sphere, fig. 4) is outstandingly suited for transmittance and reflectance measurements of solid and liquid scattering samples as well as of powdery samples. Diffuse reflected light of solid samples with rough surfaces can be collected and transmitted to detector by the sphere.



The following parameter settings have been chosen for diffuse reflectance measurement of foils:

Title:	Reflectance measurement	Measurement mode:	Scan mode
Correction:	Reference	Range:	350 - 1100nm
Display:	Reflectance/Remission	Step width:	1
Lamp changeover:	320nm	Speed :	20nm/s
Slit:	4nm	Accessories:	Integrating sphere

Because of the good reflectance properties of the sphere in visible range the spectra were taken from wavelength 350nm. The reference measurement was conducted against Spectralon[®] insert of the sphere. For sample measurement the foils were placed into position for solid samples of the sphere and fixed with the clip. Figure 5 shows the reflectance spectra of the foils.

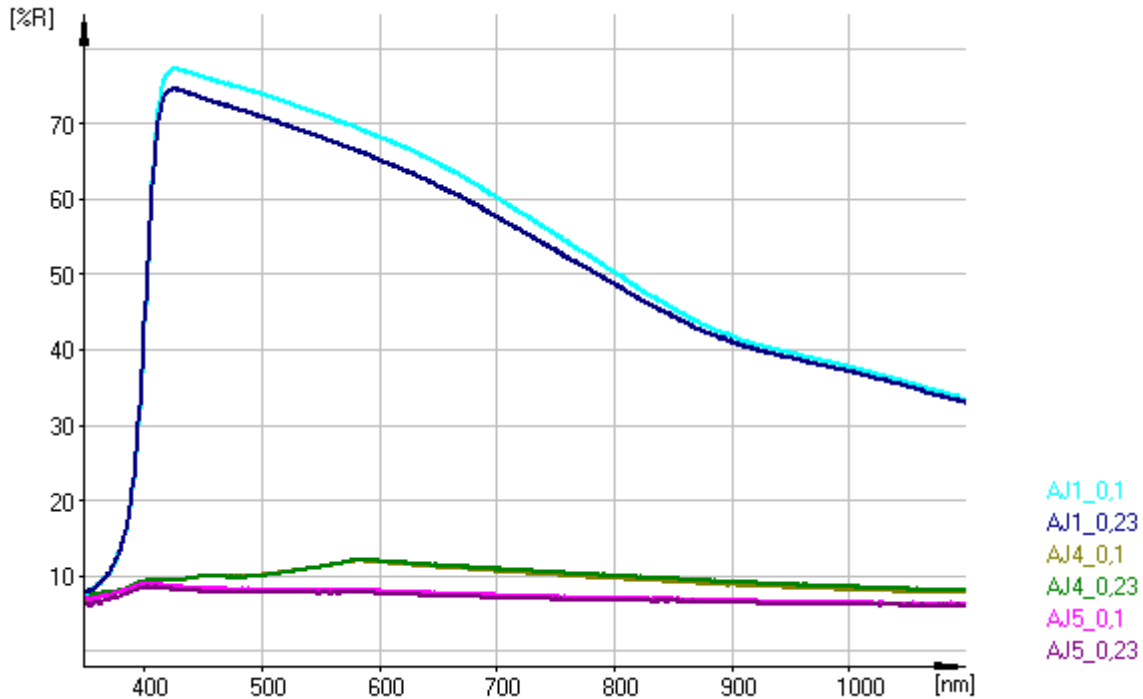
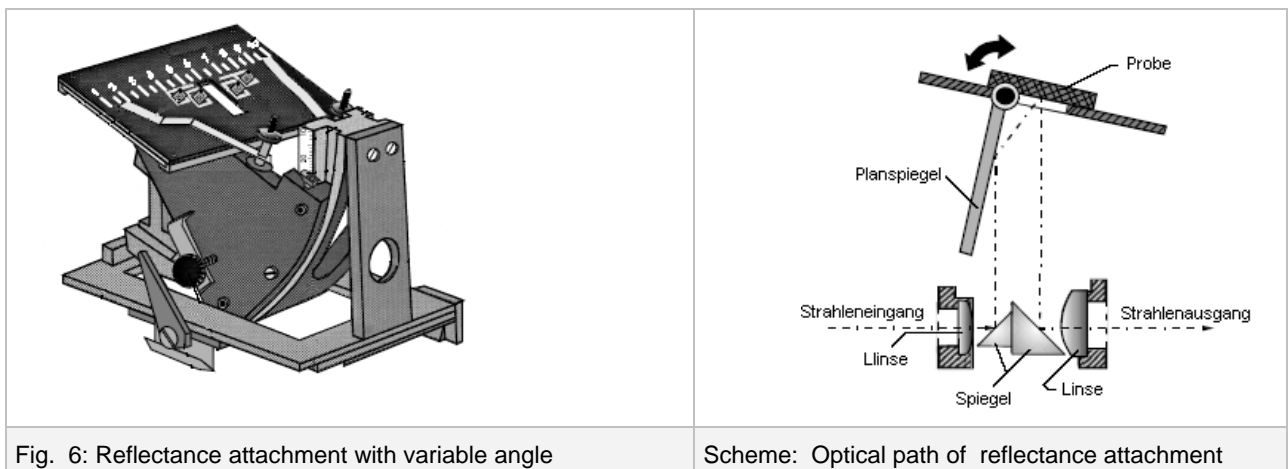


Fig. 5: Reflectance spectra of the foils taken by integrating sphere

b) Reflectance attachment with variable angle

With this accessory (fig. 6), you can determine path length and refractive index of solid samples. This is done by measuring the reflectance at different angles of reflection over a defined wavelength range. The sample table can be turned in vertical direction to vary the reflectance angle in the range 11°-60°. The optical beam path is the same for all adjustable angles.



For the measurement, an angle of 30° was used. The following parameter settings have been chosen for analysis:

Title:	Reflectance measurement	Measurement mode:	Scan mode
Correction:	Reference	Range:	200 - 1100nm
Display:	Reflectance	Step width:	1nm
Lamp changeover:	320nm	Speed :	50nm/s
Slit:	4nm	Accessories:	Reflectance attachment (variable)

Use the knurled screw to set the sample table to the desired angular position of 30°. The reference measurement was carried out by using the provided reference mirror. It was placed onto the tabletop and clamped with the sample holding clip. Sample measurement was performed analog to reference measurement. Figure 7 shows the reflectance spectra of the foils.

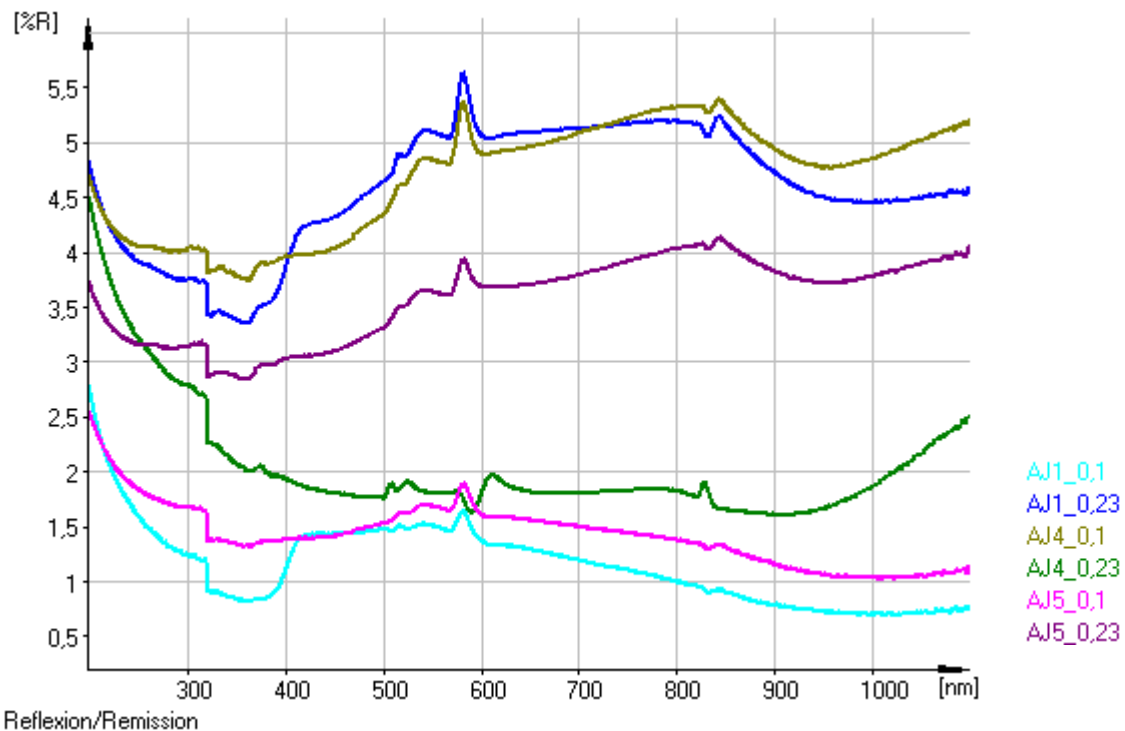


Fig. 7: Reflectance spectra of the foils taken with an angle of 30°

Evaluation

The SPECORD® 250 PLUS and the accessories stated above are an useful instrument to analyze the surfaces of such foils. Depending from the accessory which was used the taken spectra shows differences in thickness. Only absorbance and transmittance spectra of the foils AJ4 und AJ5 which were carried out with solid sample holder shows differences in thickness.

The spectra taken by integrating sphere show no differences in several thickness of the foils.

The most suitable accessory for this kind of determination is the reflectance attachment with variable angle at 30° because all spectra can be differentiated from each other clearly.

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