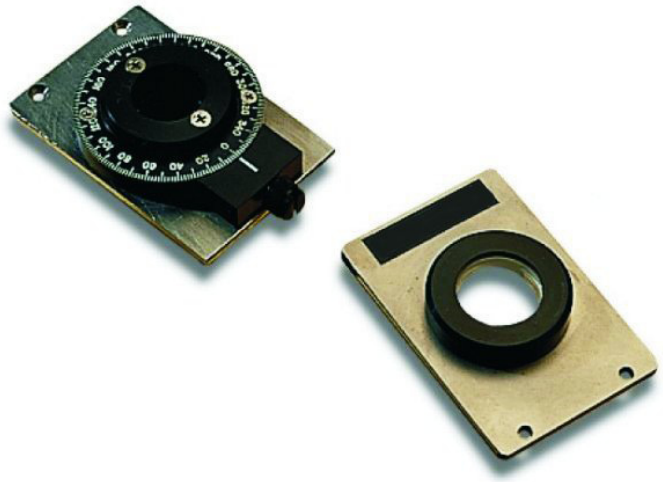
Polarizer and Depolarizer for the Agilent Cary Series UV-Vis-NIR

Data Sheet



The randomly polarized light emitted by the lamp of the spectrophotometer will be partially polarized by the time it reaches the sample. The optical components within the instrument, such as the grating and each of the mirrors, introduce some plane polarization of the light. The alignment, age, selected spectral bandwidth and the detector used will all affect the polarizing characteristics of a spectrophotometer. For these reasons, it is very difficult to quantitate the degree of plane polarization of the light in the sample compartment.

The polarization state of the instrument often does not require special consideration for the vast majority of sample analyses. The baseline measurement performed prior to the sample measurement normalizes all system dependancies including light intensity and polarization characteristics.

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When interaction with the sample changes the polarization state of the light, some additional user intervention is requried. Polarizers and depolarizers are the tools used to control the polarization state prior to, and after the sample. The transmission results are measured in terms of horizontal or vertically polarized light or, in the case of reflection 's' or 'p' polarized light.

Without adequate control of polarization, ordinate 'steps' can appear in scans at grating or detector change points, due to the different polarization attributes of these components (Figure 1).

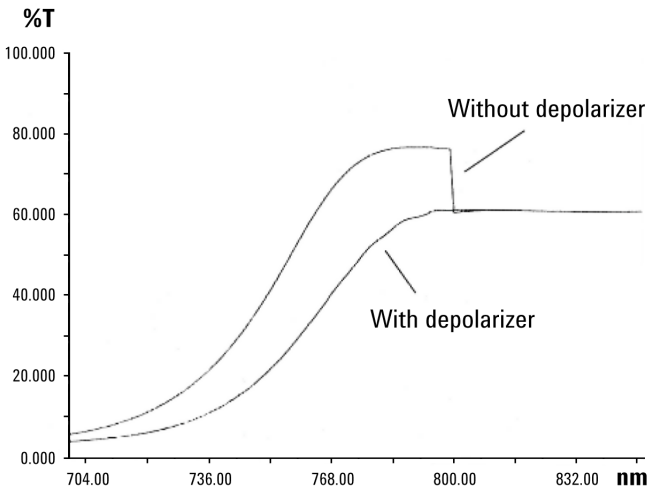


Figure 1. Ordinate steps, induced by sample polarization at the detector/grating change, can be reduced by placing a depolarizer after the sample

Controlling the plane polarization of the light beam in a spectrophotometer is necessary for particular measurements. For example, polarizers and/or depolarizers may be used in these situations:

- If the sample being measured is sensitive to the plane polarized light, for example liquid crystals, the transmission of the sample will change as the plane of polarization changes. It is thus important to control the plane of polarization of the incident beam.
- If the sample itself polarizes the incident light, the results will be affected as the detectors in the Cary spectrophotometer are sensitive to plane polarized light. A depolarizer should be placed after the sample so that the polarization will not affect the measurement.
- When performing reflectance measurements at angles greater than 10°, a polarizer should be placed before the sample to define s and p measurements and a depolarizer after the sample.
- When measuring the transmission at an angle other than normal to the surface of any electrically conductive material (such as a thin film), plane polarization will be introduced. A depolarizer should be placed after the sample.
- When performing polarimetry measurements to determine the concentration of optically active compounds, a polarizer should be used to control the polarization of the incident beam.
- When measuring anisotropic materials such as single crystals or liquid crystals, a polarizer should be used to control the polarization of the incident beam.

The polarizing principle

A polarizer will transmit only one polarized component of an incident light beam, which can be characterized as having two oppositely polarized components. One Cary polarizer option is a Glan-Taylor polarizing prism, mounted in a stainless steel slide (5 x 7.5 cm) with vernier and dial.

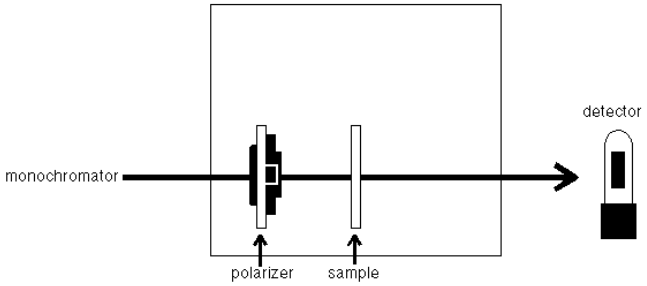
A depolarizer will transmit the polarized component of an incident light beam with minimum degree of plane polarization, converting any plane polarization to a mixture of polarizations.

The Cary depolarizer consists of two crystalline quartz wedges, one twice the thickness of the other. They are put together so that the crystal axes are at 45°. The depolarizer is neither wavelength sensitive, nor does it demonstrate a fast axis of deflect light. The depolarizer changes the plane polarization of the incident light into a polarization 'mixture' — the light passing through the depolarizer changes from parallel, through circular to perpendicular polarization many times over the area of the depolarizer. The light hitting the detector is thus a relatively non-uniform mixture of polarizations.

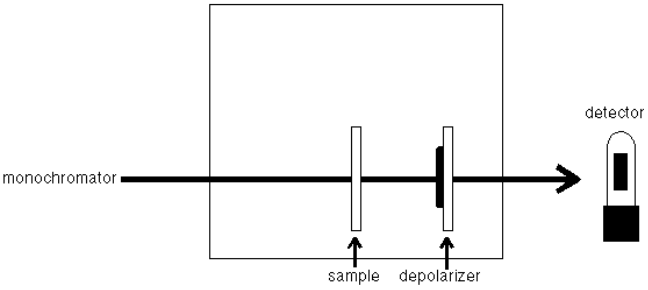
Use of polarizers and depolarizers

Both the Glan-Taylor polarizer and the depolarizer can be placed anywhere in the light beam. Like the sample compartment windows, the effects on the beam imaging are small.

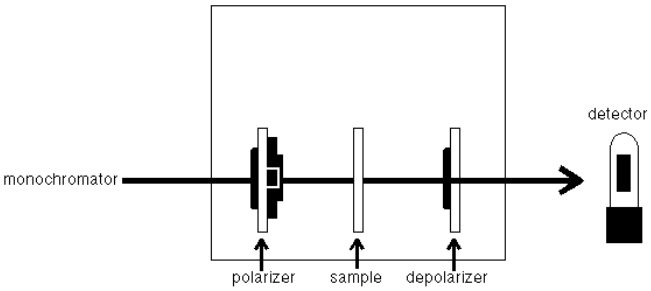
To control the plane of polarization of the incident light, the Glan-Taylor polarizer should be placed between the monochromator and the sample.



To remove any polarization caused by the sample before the light reaches the detector, a depolarizer should be placed between the sample and the detector.



The Glan-Taylor polarizer may be placed before the sample and the depolarizer after the sample. This will allow you to control the polarization of the beam incident on the sample while removing any polarization before the beam reaches the detector. Transmission measurements using an integrating sphere detector do not require the use of a depolarizer after the sample, as the integrating sphere removes polarization before the beam reaches the detector.



When using the depolarizer and/or the polarizer, a baseline should always be collected before measuring the sample.

Specifications

Glan-Taylor polarizer
Length to aperture ratio: 0.85 –1.0
Wavelength range: 250–3000 nm
Angular polarized field*: 8.5°

* Symmetrical with respect to the prism axis at 360 nm

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