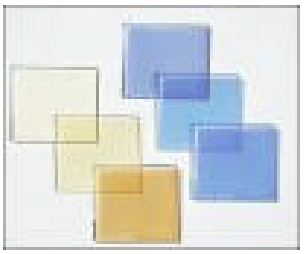
Spectral Analyzer for Film Thickness Determination of Optical Filters by Combined Transmittance and Reflectance Measurements

Partner

The instrument was developed and manufactured for Prinz Optics GmbH, a subsidiary of the PRINZ GROUP. Prinz Optics is a supplier of light guides and dichroic coatings for the filtering and reflecting of light. Prinz Optics carries out a 100 % final inspection to ensure the high quality demands and to achieve that the standards according to DIN EN ISO 9001 are being met. The tec5 UV/VIS/NIR spectrometer system is used for production control and the final inspection of the optical filters and performed for 2 years now without any problem.



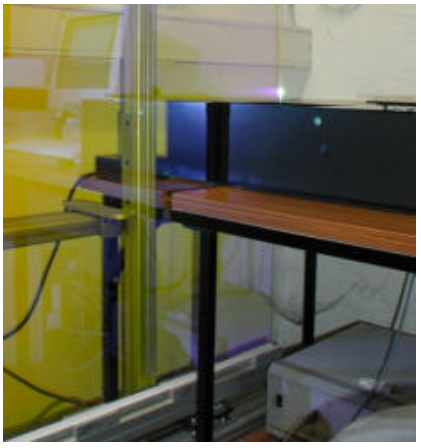
Application

The optical filters are produced using a wet-chemical coating procedure (Sol-Gel Dip Coating Process). Filter systems with up to 19 layers are produced, with product tolerances better than ± 2 nm for each layer. Because of a continuous reaction in the alcoholic solutions, it is necessary for process control to perform several film thickness measurements per day. There is a linear relationship between film thickness and withdrawal speed.

Spectrometer System

The measurement setup is based on a tec5 MultiSpec system using a Zeiss MCS spectrometer module and a deuterium / halogen shine-through light source covering the spectral range of 200-1000 nm. It is equipped with a special designed optical unit to perform transmittance measurements on plain samples under an angle of incidence from 0° or 45° and reflectance measurements under 0° in milliseconds. The film thickness is calculated iteratively. Long-term stability is checked once a day with a special zirconium film test sample, which shows that the system reproducibility is better ± 1nm for film thickness determination.

Small filters can be placed into a sample holder inside a measurement chamber. For production control also filters with bigger dimensions has to be measured non-destructively. A special design allows to insert the panes directly into a slit.



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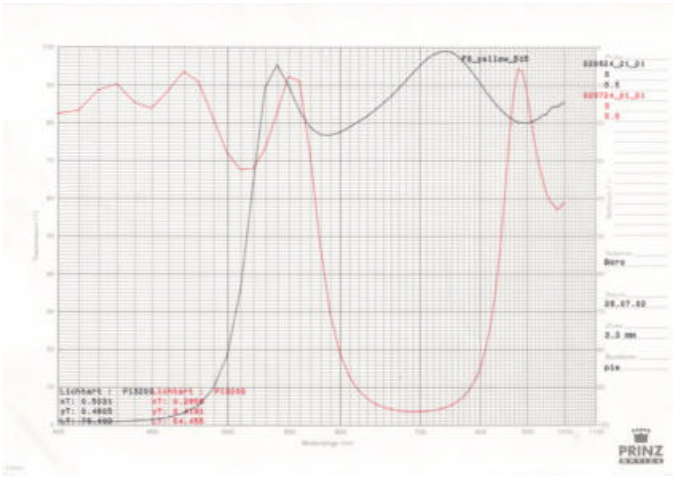
Software

A special application software was written under Visual Basic on basis of the tec5 function library for spectral data acquisition and processing. The following special functionality was implemented:

- dynamic switching of the optical channels for reflectance and transmittance measurements
- color determination with 10 standard illuminants predefined and choice of 2° or 10° standard observation
- custom module for film thickness determination
- 2 user levels for operation and administration
- special data archiving functionality
- linear regression functionality for the calculation and extrapolation of withdrawal speed vs. film thickness



Spectrum of filter type FS yellow 515

Support

By working closely with our customers and according to their application specific experience, we develop and produce custom designed components, (sub)assemblies or complete instrumentation for many different optical measurement tasks with the emphasis on 'optical spectroscopy'.

tec5 offers the performance of all hardware and software related functions:

- Contract development
- Instrument conception, design and development
- Functional units / prototyping
- Serial production

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