

Measuring Device 2: Image Analysis

- Characterization of defects on slides, substrates and coatings
- Determination of a defect-oriented permeation



8 Measuring device for Image Analysis with CCD camera

Climatic Chamber

- Storage of test cells under defined environmental conditions
- Dependence of the permeation characteristics on temperature and humidity



9 Climatic chamber

Measurement Range

Detection limit

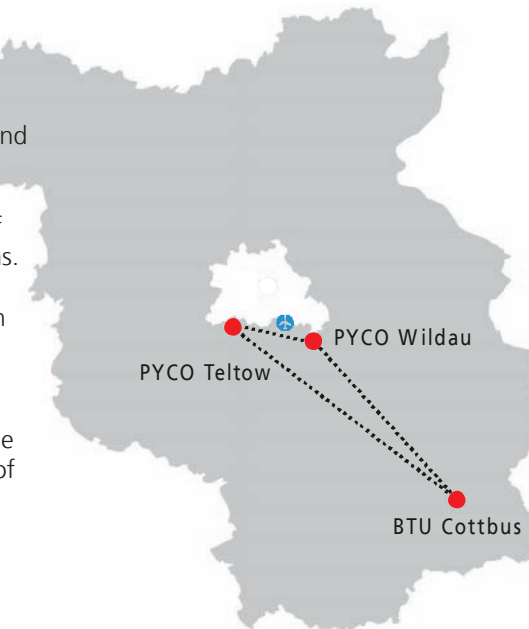
Adhesives: $10^{-2} < \text{permeation rate} < 10^3 \text{ gmm/m}^2\text{d}$ controllable via sample geometry

Barrier films: Water Vapor Transmission Rate (WVTR) $< \sim 1 \text{ g/m}^2\text{d}$

Low permeabilities of e.g. $< 10^{-4} \text{ g/m}^2\text{d}$ cause long duration of measurement, which can be adjusted by variation of the sample geometry or storage conditions.

Location Berlin-Brandenburg

New solutions require new approaches: The location of the research institute in Teltow, where the metropolis of Berlin and the federal state of Brandenburg meet, offers optimal conditions for innovative scientific research. Here, the products of tomorrow emerge from ideas and visions. Therefore, the institute's scientists have formed a creative research network with renowned universities, well-known large-scale enterprises, and various innovative medium-sized companies. Additionally, new synergy arises from the integration in the third largest location of aerospace industry in Germany.



Fraunhofer Research Institution for Polymeric Materials and Composites PYCO

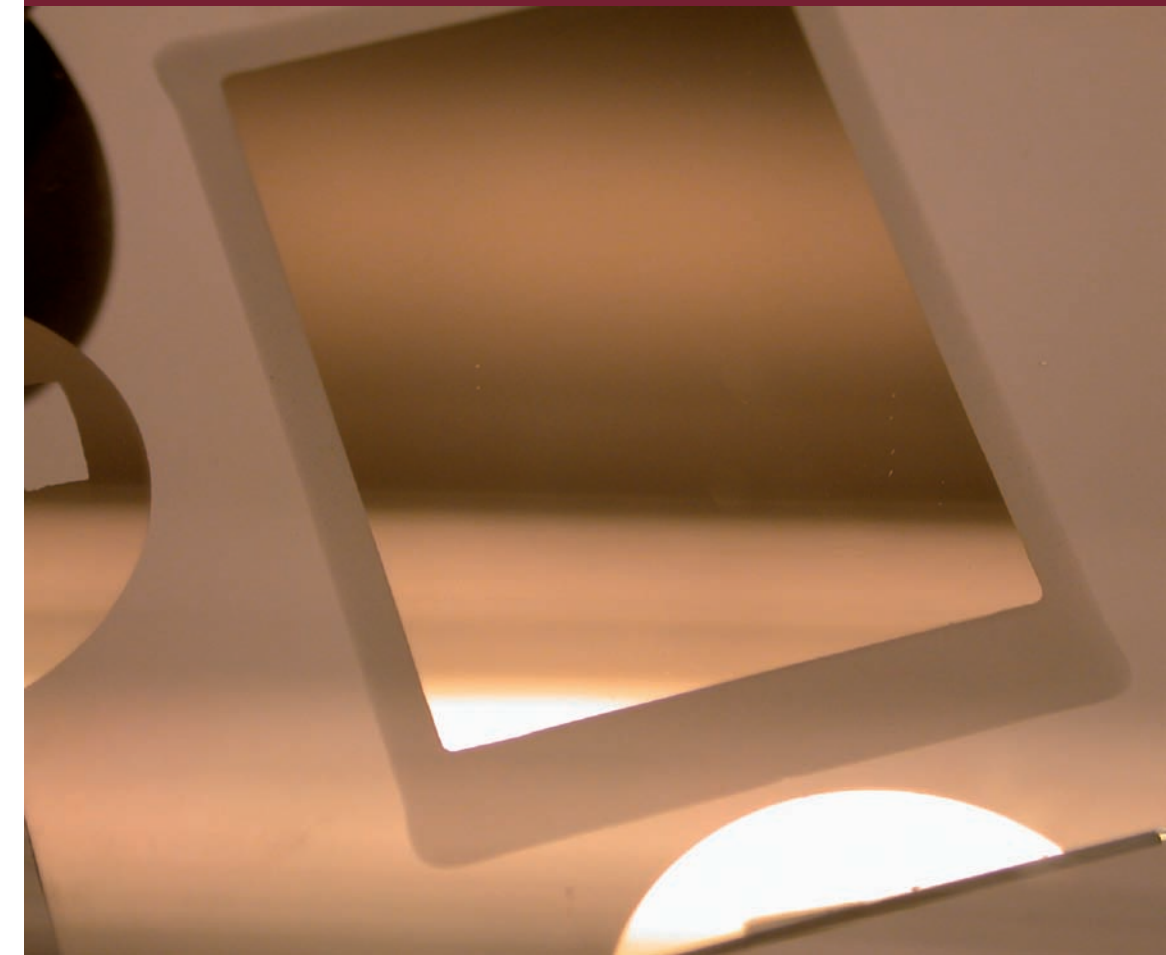
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Prices and processing time on request.



10 Main building

Application Lab for Moisture and Oxygen Permeation



Application Lab of the Fraunhofer PYCO

Chemists, physicists, engineers and technicians of Fraunhofer site as well as of the Chair of Polymeric Materials of Brandenburg University of Technology Cottbus develop highly crosslinked polymers (thermosets) for all applications with particular refer-ence to aviation, information and communication technology and instrumentation.

Today our work is particularly focused on lightweight composites and on micro- as well as optoelectronics. We develop polymer systems along the whole supply chain, beginning with the monomers up to the finished part which is unique with any material research center in Germany.

The application lab "Moisture and Oxygen Permeation" offers in particular to small and medium-sized companies a wide range of services on the characterization of polymeric materials in microelectronics. The laboratory is specialized in the analysis of materials with good barrier impact, which can be characterized insufficiently by commercial devices.

Materials

The method is especially applicable on transparent polymer layers (adhesives, casting resins, binders, laminating resins, barrier layers).



1 Vaporizer for the application of calcium layers

Applications

- Encapsulation of sensitive electronic assemblies, e.g. OLEDs
- Flexible substrates

Services

- Determination of effective permeation rates
- Characterization of volume and defect diffusion
- Estimation of the suitability of systems for encapsulation technology

Method – The Ca-Test

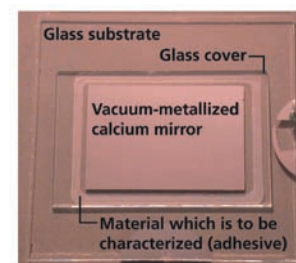
The method which is used for permeation measurements takes advantage of the high reactivity of elemental calcium. In ambient air, a calcium layer, that shines metallically, reacts spontaneously with water vapor and oxygen to transparent calcium hydroxide / -oxide.

Test cells are prepared in an inert atmosphere by first evaporating a thin calcium layer on a substrate which will then be encapsulated with the material to be tested.

The speed of the following reaction of the calcium together with the environmental conditions supplies data to determine the barrier properties of the materials tested.

Adhesives

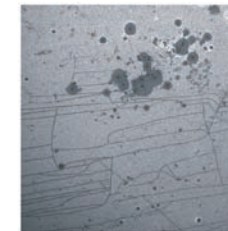
Adhesives are characterized by building a test cell with a glass substrate and a glass cover glued together with the material under investigation in a defined geometry.



2 Test cell geometry for investigation of adhesives

Barrier Films

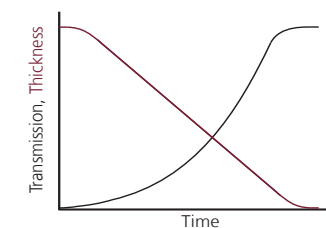
When characterizing the barrier properties of transparent films with or without (barrier) coatings, one has to distinguish between volume and defect-dominated permeation. The latter can be examined on the calcium's degradation pattern using a camera and corresponding image analysis software.



3 Calcium layer on a substrate reflecting pinholes and cracks in the coating

Interpretation

The optical transmission at each measuring step is converted to the relative calcium thickness via appropriate models. The change of thickness over time is used to calculate the permeatic value or WVTR.



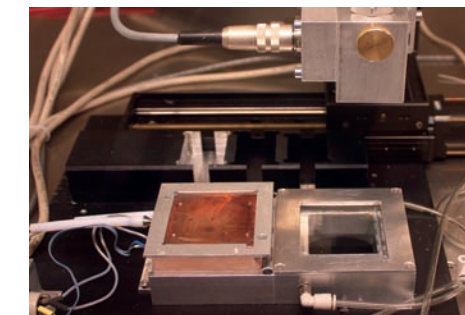
4 Schematic dependence of the optical transmission of calcium and the corresponding calcium thickness on storage time

Glovebox

- Application of the calcium layer and encapsulation of the test cells under inert N₂ atmosphere
- Application of the calcium layers with defined layer thickness using resistance-heated evaporation sources
- No corrosion of the layer until the beginning of the measurement due to inert conditions



6 Glovebox for the encapsulation of test cells



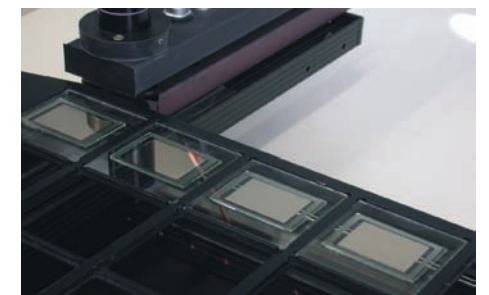
5 Dispenser for adhesives

Measuring Device 1: Optical Transmisson

- Measuring the optical transmission of the test cells which are encapsulated with the materials that are to be examined
- Duration of the measuring process primarily dependent on the materials barrier impact and the environmental conditions, e.g. temperature and humidity

Encapsulation

- Application of adhesives of different processing characteristics in a defined and reproducible way via an inhouse bild dispenser
- Adjustment for different application types as well as defined curing conditions (UV / temperature)



7 Measuring device for optical transmission