PTB innovations
Technology Offer


Raman chip, detail of the layout

Advantages

- **High Raman contrast**
- **Two-dimensional calibration**
- **Determination of the optical resolution**
- **Suitable for almost all device configurations**

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Raman-Standard

Raman microscopy is a measurement procedure for the spatially resolved determination of the chemical composition of samples. A new Raman standard of PTB allows the lateral calibration of Raman microscopes and their optical resolution to be performed with particularly high quality.

Technical description

In Raman microscopy, the inelastic scattering of light is used to characterize surfaces in a chemical and spatially resolved way. Thereby, the quality of a two-dimensional point scan depends decisively on the accuracy of the microscope table. A calibration of the scanning device with conventional test pieces is for microscopes possible only to a limited degree as these do not generate a sufficient Raman contrast or provide only one-dimensional structures, or because disturbing edge effects occur due to the topography of these test pieces.

This is why a new Raman chip has been developed at PTB. It consists of a silicon surface almost free from topography made of a material with excellent Raman activity to which very thin (approx. 20 nm) gold-palladium patterns had been applied in a coating procedure. These covers cause an attenuation of the Raman signal in the scanning process. Traceable, tessellated structures of 4 µm to 0.8 µm periodicity allow two-dimensional, long-range calibrations with a high Raman contrast to be performed. Single and adjacent point scattering centres as well as larger areas with sharp edges serve to determine the optical resolution.

Application

The Raman chip serves as calibration standard in imaging Raman microscopy. It allows image distances and the optical resolution to be exactly determined for the most diverse combinations of excitation wavelengths, lens, resolution and image size. In this way, quantitative area evaluations of Raman mappings can be traced back to the International System of Units (SI).

Economic Significance

Due to the technological progress in the field of excitation lasers and detectors, and due to a simplified handling of robust spectrometer systems, Raman microscopy is applied in many fields of chemical analysis. It is used in quality assurance for the spatially resolved characterization of biological, chemical and pharmaceutical samples and also in the investigation of semi-conductor materials, minerals and polymers.

Development status

The Raman standard has been thoroughly tested in the laboratory. A German patent application is pending.