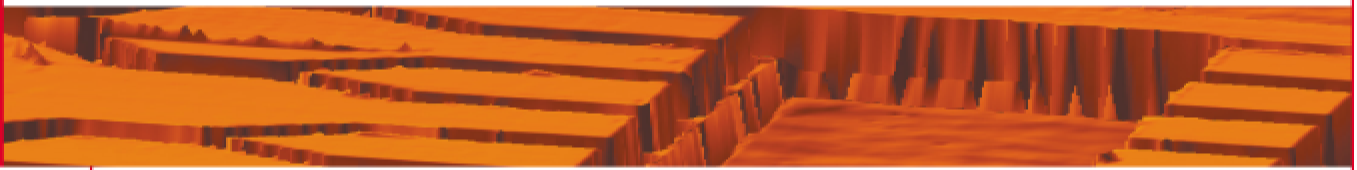
Application Note

Fries Research & Technology
Rauheit Kontur Topographie



Topography measurement on optical lenses

Measuring task:
For process control during the manufacture of plastic optical lenses, the high resolution measurement of the lens topography is performed and the radius of curvature determined.

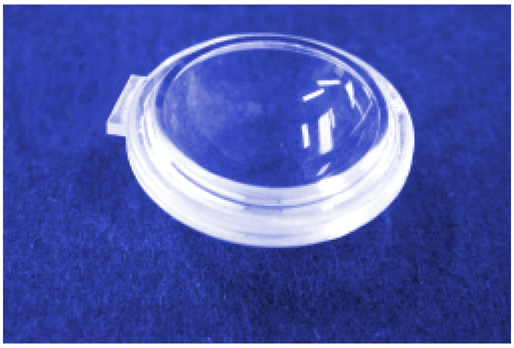


Fig 1: Photo of lens

Challenges:

Conventional contact stylus measuring systems are unsuitable for this application, as they can not scan the bottom region of the concave lenses. Also, measuring probes, which use mechanical contact techniques should not be used for optical components as they scratch the surfaces being measured.

Non-contact, optical measuring systems using auto focus or triangulation sensors have either a too small measuring range or do not provide the required resolution. The steep slope of the lens surface, up to 70 ° in the outer regions, requires a coaxial sensor with an especially large opening ratio.

The solution:
The FRT MicroProf® with a confocal, chromatic distance sensor. The sensor focuses white light onto the sample and determines the surface heights from the spectral distribution of the diffused light on the surface. For different measurements, various sensors are available with a measuring range up to 3 mm and a vertical resolution from 3 nm.
The lenses were measured with a MicroProf® with the 3 mm measuring range sensor. Using the automated vertical stitching technique, a larger height range can be measured. In this case, a lens height of 6 mm was measured.
Due to the sensor's large opening ratio, the highly polished lens surface can be measured to a slope of 30°. By spraying the surface with powder, the lens contour with angles up to 70° can be measured.

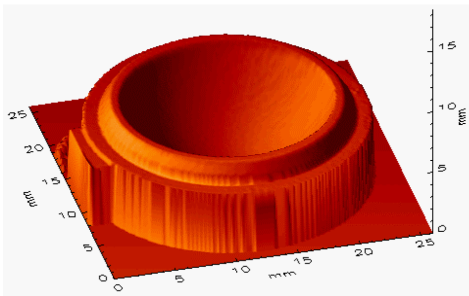


Fig 2: 3D view of measured lens

The Mark III software program contains powerful functions to evaluate and present the measured data. Fig. 2 shows a 3D representation of the lens and fig. 3 a top view with profile inserted for evaluation.

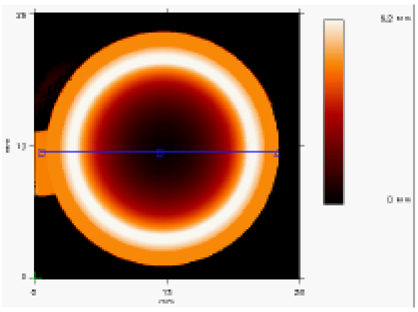


Fig 3: Top view of lens with profile inserted

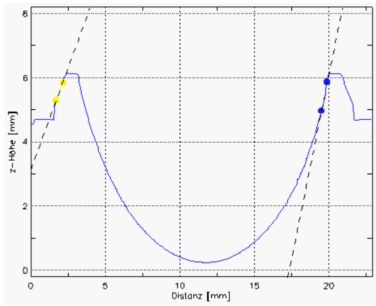


Fig 4: Profile through lens

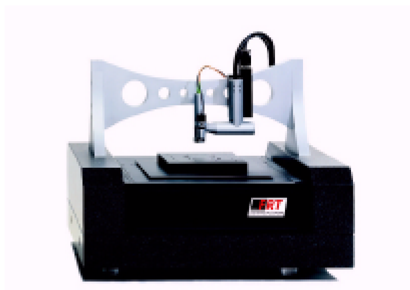
Mark III allows area and volume measurements as well as the determination of distances and angles. In fig. 4 the profile selected in fig. 3 is shown. The surface tilt is 52.3 ° (left) and 68° (right) to the horizontal.

Circles, aspheres and polynomials can be fitted to measured profiles. From a circular fit from the profile in fig. 4 the actual radius of curvature of the surface and the deviation from the nominal radius can be calculated.

The following FRT instruments may be used for this application:

The MicroProf®: all versions

The MicroGlider®: all versions



By deducting a reference plane, a height repeatability of better than 100 nm, over a 350 mm x 350 mm measuring range is achieved.

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