Surface Accuracy

When attempting to specify how closely an optical surface conforms to its intended shape, a measure of surface accuracy is needed. Surface accuracy can be determined by interferometry techniques. Traditional techniques involve comparing the actual surface to a test plate gauge. In this approach, surface accuracy is measured by counting the number of rings or fringes and examining the regularity of the fringe. The accuracy of the fit between the lens and the test gauge (as shown in figure 3.4) is described by the number of fringes seen when the gauge is in contact with the lens. Test plates are made flat or spherical to within small fractions of a fringe. The accuracy of a test plate is only as good as the means used to measure its radii. Extreme care must be used when placing a test plate in contact with the actual surface to prevent damage to the surface.

Modern techniques for measuring surface accuracy utilize phase-measuring interferometry with advanced computer data analysis software. Removing operator subjectivity has made this approach considerably more accurate and repeatable. A zoom function can increase the resolution across the entire surface or a specific region to enhance the accuracy of the measurement.

SURFACE FLATNESS

Surface flatness is simply surface accuracy with respect to a plane reference surface. It is used extensively in mirror and optical-flat specifications.

POWER AND IRREGULARITY

During manufacture, a precision component is frequently compared with a test plate that has an accurate polished surface that is the inverse of the surface under test. When the two surfaces are brought together and viewed in nearly monochromatic light, Newton's rings (interference fringes caused by the near-surface contact) appear. The number of rings indicates the difference in radius between the surfaces. This is known as power or sometimes as figure. It is measured in rings that are equivalent to half wavelengths.

Beyond their number, the rings may exhibit distortion that indicates nonuniform shape differences. The distortion may be local to one small area, or it may be in the form of noncircular fringes over the whole aperture. All such nonuniformities are known collectively as irregularity.

Surface inspection

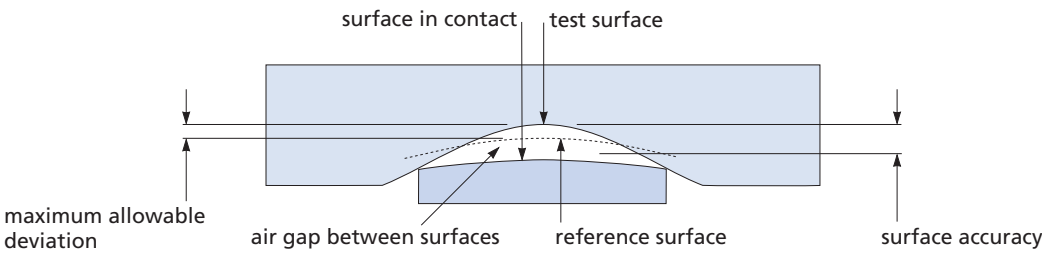

Figure 3.4. **Surface accuracy**