Aspheric technology -

a precondition for modern methods of lens construction

Author : Reinhold Litschel, Bad Kreuznach

Modern, computer-supported processes for lens design, lens manufacturing, and the requisite measurement technology make it increasingly possible to use aspheric lenses in the field of precision optics. The utility of aspheric surfaces in an optical system lies less in saving individual lenses than in the possibility of entirely new methods of lens construction. SCHNEIDER-KREUZNACH recognized this very early, and invested in the required technologies and developed them to the point of full-scale production.

1. Theory

As the name suggests, aspheric surfaces differ from the spherical form of customary lens surfaces, and therefore require completely different processes of manufacture and testing. In the process employed by Schneider Kreuznach, the aspheric lens surface is shaped and polished with high-precision CND machines, a small section at a time. The deviations from the desired surface form which remain after polishing are measured by interferometry with the help of computer-generated holograms, transmitted to the polishing machine, and there, in a correction phase, reduced by further polishing to an acceptable minimum.

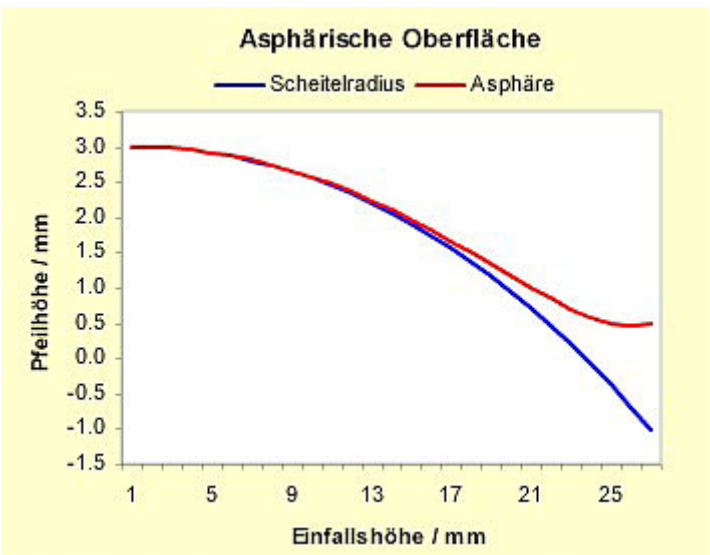


Figure 1:

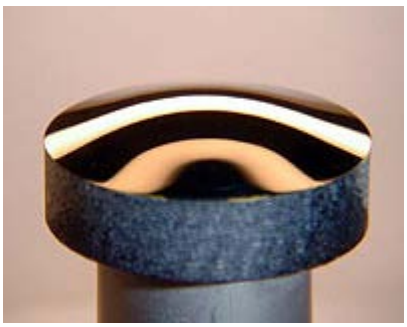
Comparison between a spherical and an aspherical surface

In the diagram above, the outline of an aspherical profile is traced in comparison with spherical form present in the middle of the lens. In the non-proportional representation, it can be seen that the aspherical

lens deviates at the edge by approximately 1.5 mm from the spherical form. As reference values for acceptable deviations from the desired surface form, a global error of < 1 µm and a local error of < 0.1 µm can be specified.

2. Production

Picture 2 shows an example of an aspheric surface after polishing and before the final centering process. The lens here is still cemented to the workpiece mount. The reflections of light from two fluorescent tubes make it possible to clearly recognize the aspheric profile, comparable to the desired profile shown in the diagram.



Picture 2 Aspheric lens surface, after polishing

3. Series of lenses

The **SUPER-SYMMAR**-Series **XL ASPHERIC** , which has since been enlarged to four lenses, demonstrates in an impressive way what the effect of an aspheric surface has on the size of the lenses. The reduced lens size (see Picture 3) allows for smaller shutters and less glass, and in some cases reduces the weight in comparison to spherical lenses by a half. The performance data in contrast to these lenses in some cases even better, e.g., the maximum aperture which is larger by an f-stop and the larger angle of view.?

Picture 3: Comparison of a traditional and new aspherical lens

SCHNEIDER-KREUZNACH
Aspherical Lenses :

SUPER-SYMMAR
4.5 / 80 XL ASPHERIC

SUPER-SYMMAR
5.6 / 110 XL ASPHERIC

SUPER-SYMMAR
5.6 / 150 XL ASPHERIC

SUPER-SYMMAR
5.6 / 210 XL ASPHERIC

foto@schneiderkreuznach.com

FON : +49 671 601-0 ..... **FAX** : +49 671 601-286 ..... **E-mail** : industrie@schneiderkreuznach.com