Gaussian Mirrors

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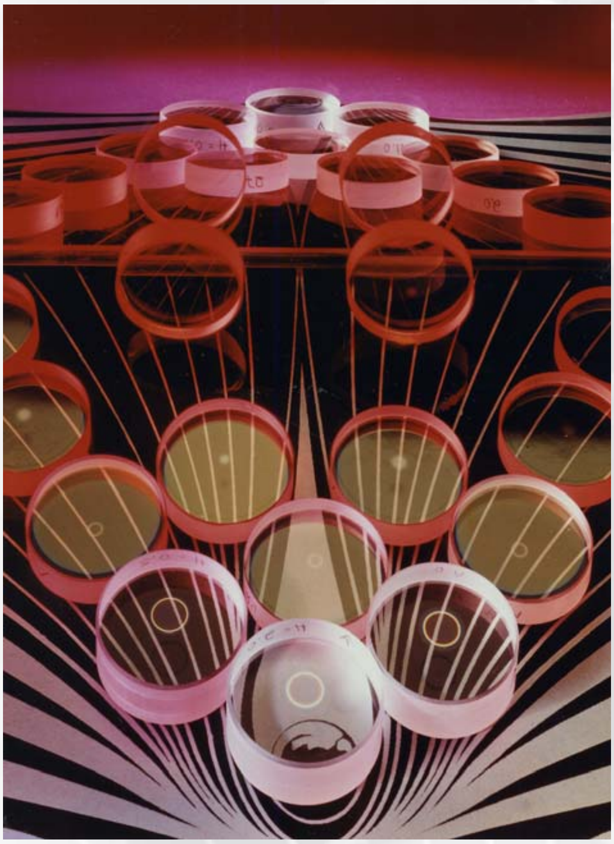
NEW SOURCE TECHNOLOGY LLC

LASER COMPONENTS ®



The beam quality of lasers can be significantly improved through the application of Gaussian output couplers. Many other applications require the use of optics having defined local reflection values. An example of this is beam formation using Gaussian mirrors.
The high intensity of the laser beam requires the use of components with a high damage threshold. Dielectric coatings are best suited to meet these requirements. LASER COMPONENTS specialises in the production of such customer-specific coatings.

Structure

The operating principle is based on a Fabry-Perot etalon. Fig. 1 shows a cross section through a monochromatic graded-reflectivity coating. A so called spacer layer *S* of varying thickness *d* is enclosed by two identical mirrors *M*. Where *d* is an even numbered multiple of $\lambda/4$, the system will be fully transparent for wavelength λ, i.e. the reflection vanishes. On the other hand, if *d* is an odd numbered multiple of $\lambda/4$, reflectivity will be governed by the reflection of the mirrors *M*. Function *R(r)* thus determines local reflection. In the simplest cases this function can be circular (see photos). LASER COMPONENTS offers circular versions as standard. The production method used ensures exact symmetry for such geometric patterns. Other customer specified reflection profiles can be provided on request.

The Fabry-Perot principle used in the structure ensures that the phase shift caused by the coating is minimised. Wavefront deformation of coherent radiation fields is kept at a minimum.

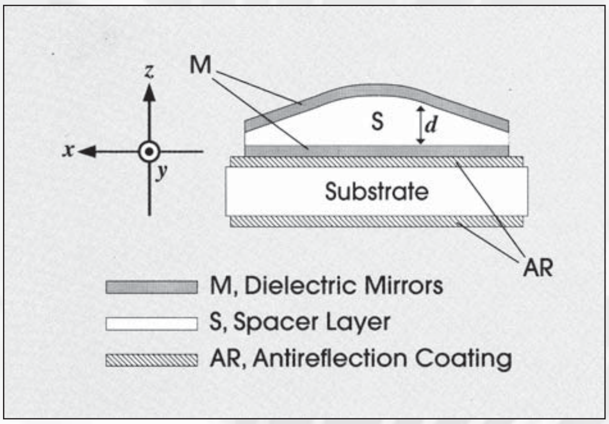


Fig. 1:
Cross section of a graded-reflectivity coating; the y-axis is orthogonal to the plane of the drawing.

Characterization

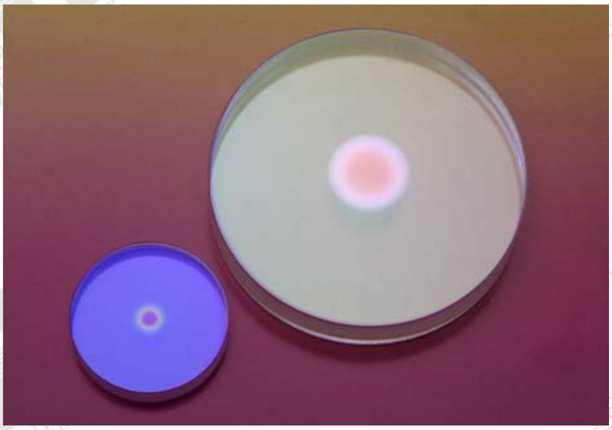
LASER COMPONENTS offers graded reflectivity coatings for many fields of application. Determining the optimum solution for a special application will, of course, require some information from the customer. The following paragraphs explain all the significant parameters involved. The discussion is limited to coatings with circularly symmetric profiles.

Ordering Information

Special substrates are normally used for Gaussian mirrors. LASER COMPONENTS offers meniscus, planoconvex and other special blanks according to customers wishes. We are pleased to support you in finding the right substrate for your application.

Example:

GR	1064	/	25	—	1.8	—	4	UV (fused silica)
Product Code	Wavelength		R_o		$1/e^2$ - Radius w		Order n	Substrate



The Gaussian formula is defined as:

$$R(r) = R_O \cdot \exp[-2(\frac{r}{W})^n] + R_{out}$$

with

Values of Reflectivity, R_0, R_{out}

LASER COMPONENTS normally defines all coatings with $R_0 > R_{out}$ as GAUSSIAN MIRRORS (GM); this includes the so-called super-gaussian mirrors with a Gaussian order higher than 2. It is generally assumed that $R_{out} = 0$ applies for GMs; however other values can be specified by the customer.

Lateral Dimension, w

The lateral dimension w is the semi-diameter of the spot (spot radius) and is defined by the R_0/e^2 position.

Gaussian Order, n

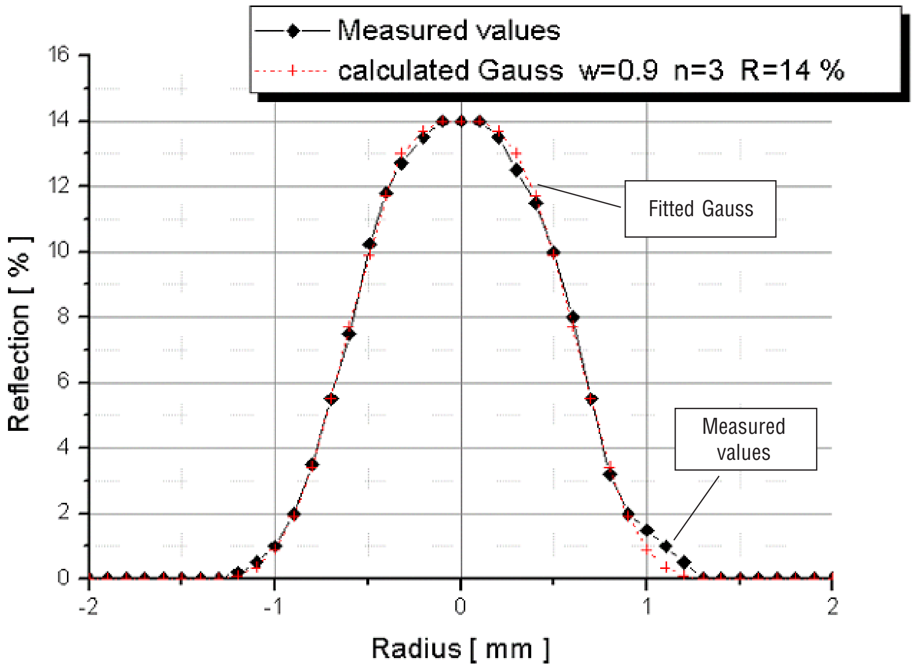
Here only one value, *n*, is required.

Wavelength of Operation, λ

Dielectric coatings having a defined reflectivity function *R(r)* are generally monochromatic. It is thus essential to specify the desired wavelength.
LASER COMPONENTS currently offers Gaussian mirrors for 1064 nm. Other wavelengths can be offered on request.

Laser Beam Parameters, E, τ, f

Specifying the pulse energy, *E*, pulse duration, τ, and repetition frequency, *f*, of the laser will ensure that the damage threshold of the components is sufficiently high for the application. A high damage threshold coating version will be provided for components used in high-power laser operation.



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