

SIEMENS

Göbel Mirrors for Parallel-beam Optics

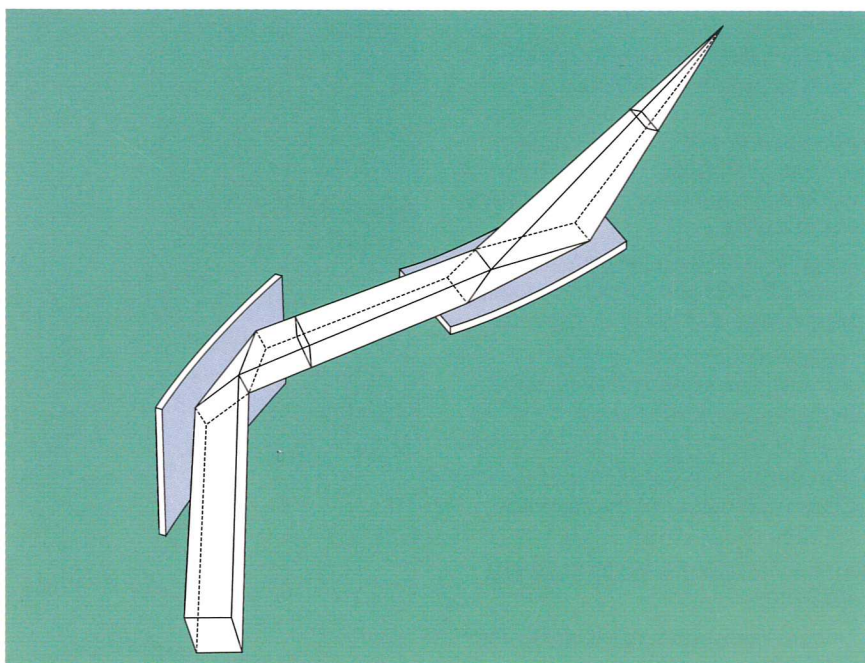
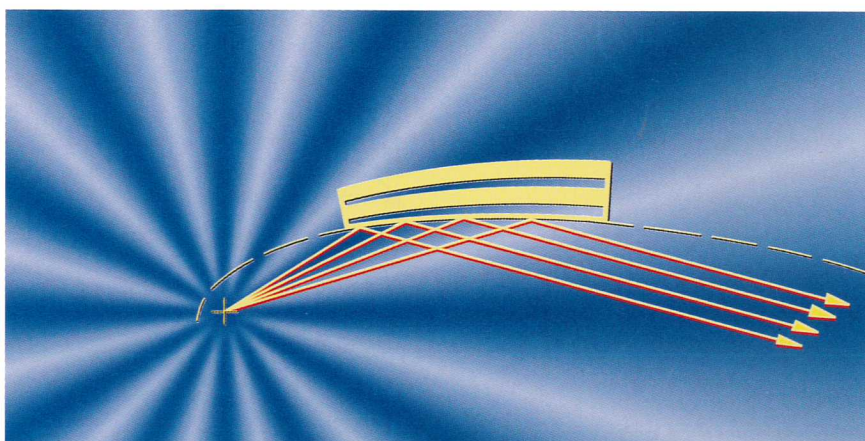
Spectrometry
Diffractometry
Single Crystal Diffractometry

Unlike visible light, X-rays cannot be directed with conventional optical elements, such as lenses. While total reflection mirrors, known as Franks' Mirrors, can reflect an X-ray beam at angles of incidence below 0.1° , Bragg diffraction from crystals is the only way to influence the direction and divergence of an X-ray beam at higher incidence angles. With this method, a particular wavelength is deflected only at particular angles, called Bragg angles. With conventional monochromator crystals, the X-ray beam can only be deflected in well determined directions, but the divergent beam from the X-ray source cannot be effectively controlled. However, this becomes possible with Bragg diffraction from Göbel Mirrors.

In contrast to conventional monochromator crystals, Göbel Mirrors are multilayer crystals manufactured so the distance d between the layers varies in a controlled manner. The appropriate gradient in the d -spacings depends on factors which include the wavelength, the location of the mirror with respect to the source, and the application for which the mirror is designed.

Furthermore, Göbel Mirrors are parabolically bent which causes a divergent beam striking the mirror at different locations and angles to yield a diffracted parallel beam. With Bragg diffraction, the radiation is monochromatized to $K\alpha_{1,2}$ while $K\beta$ and Bremsstrahlung are suppressed.

Göbel Mirrors provide very high intensity of the diffracted $K\alpha_{1,2}$ radiation.



If a single parabolically bent Göbel Mirror is placed in the beam path so the line focus of the X-ray source is at the focus of the parabola, then approximately 1° of the divergent primary beam will be collected and transformed into a parallel beam (D 5000 X-ray diffractometer, upper picture).

For an X-ray source with point focus, a second Göbel Mirror turned 90° collimates the beam in the direction perpendicular to the first mirror (GADDS X-ray diffractometer, lower picture).