Optics | Technology Offering

Refractive lenses of rolled and structured films for X-ray optical systems

Area of application

The newly-invented X-ray lens allows the focusing of X-rays on a point and also distinguishes itself through low absorption losses. It is especially interesting for X-ray analyses for which a high radiation intensity is required.
However, the manufacturing method is not limited to use with X-ray radiation; it can also be adapted for electromagnetic radiation of any wavelength.

State of the art

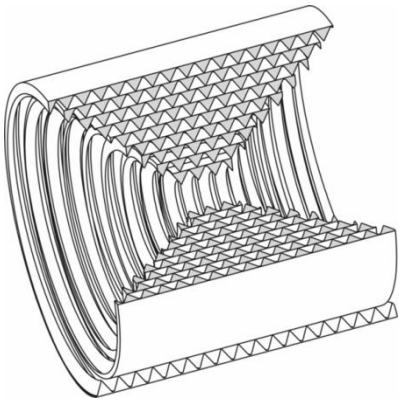
The refraction of X-rays, that is, electromagnetic radiation in a wavelength range from 5 pm to 50 nm, is especially problematic because the refraction of the materials that can be penetrated sufficiently by X-ray radiation is so low that customary lenses must assume comparatively extreme shapes. Among other things, this means that the path of the radiation in the lens material and thus the absorption is so great that the intensity of the X-ray is no longer sufficient for particular applications. This problem is counteracted by lenses consisting of many optical sub-elements with refractive surfaces, of which a majority are located in the edge area of the device. This way, a stronger refraction of the radiation in the edge area and thus a focusing of the radiation is achieved.
However the manufacturing of systems such as the Clessidra lens is time-consuming. In addition, a point focus can only be achieved by combining several lenses turned against one another, which detracts from the transmissivity of the entire arrangement.

Innovation

In the course of a project funded by the Baden-Württemberg Stiftung, a refractive optical element was developed, that is easy to manufacture, demonstrates good transmissivity, and can realize both a point focus as well as large apertures.
The inventor achieves the necessary refraction of the radiation through optical sub-elements, which, using industrially proven methods, are applied to a carrier film in the shape of triangular structures. According to an algorithm the structured film is then cut as a belt with front sides of different widths, so that when wrapping the film, for example, around a glass fiber, more refractive structures are located in the edge area than near the optical axis. Thus, with a simple manufacturing process, a refractive optic is created with tenfold intensity increases in the focus, whose maximum achievable aperture is not limited by the manufacturing process.

Your advantages at a glance

- ✓ Easy manufacturing of refractive X-ray lenses with large aperture
- ✓ Point focus with diameter of less than 10 µm
- ✓ Increase of the intensity by a factor of 10 in the focus
- ✓ Great transmissivity and low absorption
- ✓ Polyimide prototypes exist



Schematic drawing of the inner structure of roll lenses (illustration: Karlsruher Institut für Technologie)

Technology transfer

Technologie-Lizenz-Büro GmbH is commissioned with the exploitation of this technology and offers companies the possibility of licensing.

Patent portfolio

EP 10 727 438.3 granted and validated in Germany, France, and Great Britain.
DE 10 2009 031 476.8 pending.

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