

Workshop »Coatings for Optics and Optical Components«

Flexible approach for the production of slanted surface relief gratings by reactive ion beam trimming

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The production of surface relief gratings (SRG) plays a crucial role in nano-structuring today. Applications range from laser mirrors to manufacturing of waveguides for mixed and augmented reality. Augmented (AR) and mixed reality (MR) applications have recently gained large interest. In order to fabricate lightweight near eye displays. State of the art AR as well as MR devices use optical waveguides with diffraction gratings in order to guide light from a display by total internal reflection (TIR) into the view of the human eye. SRGs are used for coupling the light from the source into the waveguide and out of the waveguide towards the eye. To suppress higher diffraction orders and thus maximize the light yield those gratings are slanted.

Ion Beam Trimming (IBT) is a well-established method in the MEMS industry to locally change the thickness of a functional layer on a substrate. Localized ion beam etching was applied to etch the trenches for the grating. Varying the ion irradiation dose (by means of dwell time variation) defines the trench depth on a local level. The angle of incidence of the ion beam directly transfers into the substrate as the slant angle and can be varied independently of the dwell time, providing the unique possibility to achieve a continuous variation of the slant angle and trench depth across one die.

This work shows how ion beam trimming offers a very flexible approach for the production of slanted surface relief gratings on different substrate materials and different grating geometries regarding width and pitch of the gratings.