RESISTLESS LASER TECHNIQUES FOR MANUFACTURING
DIFFRACTIVE OPTICAL ELEMENT MASKS

Description
Development of high-performance diffraction optics has issued a new challenge, manufacturing of half-tone masks.
The Institute of Automation and Electrometry SB RAS has developed the methods of direct laser recording of half-tone masks on the media whose transmittance change under the effect of laser radiation (LDW-glasses and amorphous silicon films).
A circular laser writing system (CLWS) is developed to apply the new technologies: a substrate with a recording material is being rotated by an aerostatic spindle, while a concentrated argon laser beam (0.5 mcm in diameter) moves along the radius of the substrate with accuracy of 0.1 mcm. The beam power is modulated synchronously with rotations of the substrate.

Application of LDW-glasses for the half-tone technology:
(a) DOE half-tone mask for collimating optics for a semiconductor laser;
(b) Fresnel lenses with a diameter of 10 and 20 mm on fused quartz substrates;
(c) Fresnel lenses on silicon substrates (lens diameter: 5 mm, N.A.: 0.58);
(d) half-tone mask with a diameter of 50 mm for manufacturing Fresnel lenses on a silicon substrate (reduction 1:10).

Technical appraisal and economic benefits
• Simplified manufacturing process;
• higher accuracy;
• capability of writing on curved surface, capability of writing on large and thick substrates, in the wide range (from mcm/s up to m/s) of laser beam speeds and in a wide wavelength range.

Application areas
Manufacturing of diffractive optical and microoptical elements.
**Development stage**
The pre-production model of the circular laser writing system has been created.

**Patent situation**
Protected by the RF patent (1990).

**Commercial offers**
Contracts for manufacturing and delivery of CLWS, half-tone masks, and diffractive elements.

**Estimated cost**
Circular laser writing system: US$ 200,000-250,000.
Half-tone masks: US$ 1,000-5,000.
Precision diffractive elements for testing aspherical surfaces: US$ 1,000-10,000 depending on parameters.

**Contacts**
Cand.Sc. Tadeush N. Mantush, Scientific Secretary
Institute of Automation and Electrometry, Siberian Branch of the Russian Academy of Sciences
1, Prosp. Akademika Koptyuga, Novosibirsk, 630090, Russia
Phone: (383) 333-35-86
Fax: (383) 333-38-63
E-mail: mantush@iae.nsk.su
http://www.iae.nsk.su