

Project Number: EG21_374/0026828
Provider: Ministry of Industry and Trade
Realization Period: 08/2021 – 05/2023



Project title:

NEW GENERATION LIGHTING SYSTEMS

The main objectives of the project are research and development activities in the area of new approaches to the construction of lighting systems which use sophisticated diffraction optical elements and their systems. The key idea of the project is to integrate a light source and an optical system into a single unit in the form of a layered system. Such a functional unit can subsequently be manipulated as an electronic component.

The IPP ASCR TOPTec Centre contributes to the project in the field of research on the processes of transferring diffractive structures into glass using press moulding. The transfer of very fine structures into glass is generally a technologically demanding and complicated task, which has not yet been sufficiently mastered for large-scale production. Diffractive structures are microscopic structures formed on the surface of an element which interact with light. They define the direction of propagation for given frequencies from the spectrum of the light source. They enable the lighting systems to effectively use light intensity by directing light in the desired way. Thus, in some applications, unwanted light pollution can be minimized or, potentially, eliminated.

Figure 1:

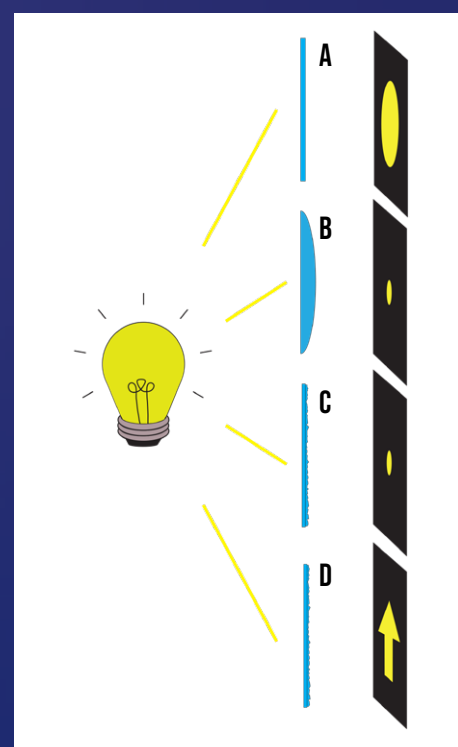
Scheme of a light beam modulation during transmission through an optical element:

A) through a plane-parallel plate without specific surface modification;

B) through a conjugate lens;

C) through a plane-parallel plate with diffractive structure with a conjunctive lens function;

D) through a plane-parallel plate with diffractive structure with an arrow function.



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Compared to plastics, which are currently used for recording diffractive structures, the advantages of glass materials lie in their mechanical resistance, temperature resistance and UV light transmission. These parameters make it possible to expand the application field of utility of the manufactured products primarily in the area of directional luminaires and also in the area of high-power radiation sources or modulation of radiation in the UV region. The aim is, therefore, to define and to optimize suitable parameters of the press moulding process for selected types of die materials with a defined pattern, as well as parameters of the impression material using the NanoTech pressing technology. These will then serve as a starting point for the subsequently developed technology for transferring structures into glass for automated production.

Areas of research

- Press moulding process optimization, selection of press moulding material, parameters of pressing for selected materials of the die and the pressed part.
- Thin layers with a focus on temperature resistance to prevent a chemical reaction between the die relief and the pressed part material.
- Development and application of measurement techniques for characterization of transferred diffractive structures.

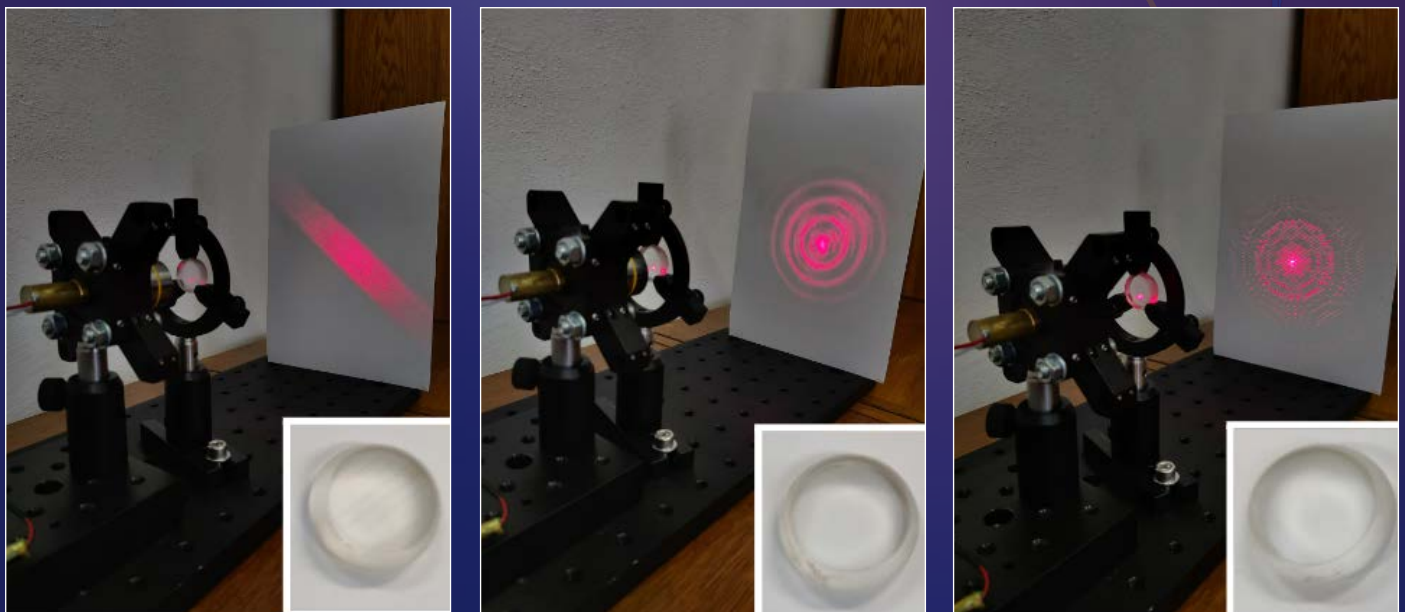


Figure 1: Plane-parallel plates with different functions of optical beam modulation.