RADIATION COLOURING OF OPTICAL MATERIALS: CRYSTALS AND OPTICAL GLASSES UNDER – IRRADIATION

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Since the development of the cosmic space, the problem of the radiation stability is very crucial for the on-board electronic and optical techniques of the spacecrafts. Under the irradiation by the charged particles or high-energy photonic beams, dielectric optical materials change their transmittance spectra. The ionized radiation causes a set of the complex processes, which sequences are not always predicted theoretically. This reason leads to the necessity of the experimental investigations, concerning the effects of the ionized radiation on the different types of the optical materials, in order to provide the reliable forecasting behaviour for one or another optical device under its functioning in the radiation fields.

The presented work contains the results of the investigations for the γ-irradiation effects on the transmittance spectra of the optical components made of the most commonly used materials, such as crown glass, uviol glass, melted quartz, radiation-stable glass. The Nd:YAG crystals, widely used in the laser techniques, and also active elements produced on their base were subjected to the irradiation.

The effects of the γ-radiation exposure doses on the transmittance in the ultra-violet, visible and near IR spectral regions are analyzed in this work. The studied absorption of the radiation colour centers has a relatively large half-width, and their total spectrum covers the region from the UV to near IR wavelengths. Depending on the glass contents, the spectrum of the induced absorption is characterized by the different degree of colouring.

The comparison between the transmittance spectra of the optical components, measured before and after irradiation, is important for the prediction of the transmittance ability for the optical device in the radiation field and for the identification of the elements, the least stable to the ionized radiation.

Based on the LASER KIT ALPHALAS principal model, the investigations concerning the γ-irradiation effects on the diode-pumped solid-state laser parameters were carried out. The active element (Nd:YAG) was subjected to the irradiation.