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BIOMEDICAL APPLICATION OF THE DYNAMIC HOLOGRAPHY RECORDING ON THE POLYMER FILMS WITH BACTERIORHODOPSIN

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[**Introduction**] In recent years dynamic holography is coming into used extensively for the investigation of biological objects. Only low-intensity light sources may be applied for this purpose. In this connection the polymer films with fragments of the purple membranes containing protein bacteriorhodopsin (BR) will hopefully be found a potential just for biomedical application.

[**Materials and Methods**] Protein BR is similar to the protein rhodopsin, containing in the human eye and their optical properties are similar in appearance. The polymer films with BR have high photosensitivity, practically unlimited quantity of cycles of information recording - removing. It allows to use low intensity current work gas lasers (processing of optical signals with the light power density 10 $\mu W/cm^2$ is possible).

[**Results**] The possibility of the application of the dynamic polarization holography recording on the polymer films with BR for biological object control is propose in this work. The polarization of light wave scattered from tissue depends on the subtlest difference between tissue state. This scattered wave served as an object wave for dynamic holographic recording. The isotropic polymer film based on BR with anisotropic nonlinearity allows to register the object wave polarization. In such manner the slightest difference between tissue state may be determined from amplitude and polarization analysis of the diffractive wave.

[**Conclusion**] The dependencies of the diffractive wave amplitude and polarization on the light recording intensity at various polarization state of the recording beams are studied both experimentally and theoretically. The weaken He-Ne laser irradiation (λ=633 nm) is used for holography recording. The spatial resolution is more than 5000 lines/mm.

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A Prototype of Ho:YLF Laser for Biomedical Applications

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Introduction- Laser emission in the near IR of various rare-earth ions doped in crystals hosts has attracted considerable attention in the recent years for its applications in several different fields. In particular, the 2.1 μm laser line of Ho^{+3} has potential applications such as in optical communications, rangefinders, industrial processes and in medicine. Ho^{+3} exhibits a relatively long lifetime of the emitting level $^5I_7$ which results in a high energy storage capability and efficient Q-switched operation. Transmission of middle infrared radiation is possible along readily available quartz fiberguides , which are essential components of endoscopic laser devides with a wide range of applications.

Materials and Methods- We shall report a construction of a pulsed laser operating at room-temperature designed for medical applications and emitting at a wavelength of 2,064 μm. The active medium was a YLF crystal codoped with Er, Tm and Ho ions. The laser rod, with plane-paralel ends (6 X 80 mm) was placed at the focus of an elliptical reflector (silver plated and water cooled) with a xenon flashlamp in the other focal point. The laser resonator consisted of a back mirror (R ~100%) and front mirrors with R ranging from 65% to 99%.

Results- We obtained single shots with maximum energy of 1,5 J (360 J of input energy) , and pulsewidth of 400 μs. This prototype was used to investigate the threshold for visible modification of enamel and dentin surfaces *in vitro* focusing the laser beam with lenses in the teeth. The threshold was 130 mJ/pulse without focusing the laser beam ($\varnothing \approx 5$ mm) and there is no visible charing, maintaining the original color of the teeth.

Conclusions- This results suggests that the Holmium laser can be used for removal of surface caries.