Polarization-sensitive laser photoexcitation and filamentation in diamond

Krasin G K[@], Gulina Y S, Kuzmin E V and Kudryashov S I

Lebedev Physical Institute of the Russian Academy of Sciences, Leninsky Avenue 53, Moscow 119991, Russia

[@] krasingk@lebedev.ru

The parameters of the strong electromagnetic wave can change during its propagation inside of solid media due to the action of nonlinear optical effects [1]. Among the parameters of the laser radiation that affect the nonlinear optical interaction in bulk crystalline dielectrics the laser polarization along with the wavelength and energy (intensity) could be rather important. The influence of ultrashort laser pulses polarization on the processes of nonlinear optical interaction with crystalline materials was demonstrated recently [2]. The study of the effect of polarization on the filamentation process is of particular interest, given the fact that laser polarization determines the direction in the Brillouin zone and its corresponding bandgap for photoexcitation of the dielectric media [3]. In this work the study of the filamentation process was carried out in HPHT type IIA diamond using near-IR ultrashort pulses. As a result the photoluminescence yield and filamentation threshold power demonstrated azimuthal dependencies (modulation up to 50%) in the low energy region. In higher energy region the dependencies show almost isotropic character (in regards to the laser polarization), presumably related to the absorption properties of formed dense plasma.

The work was financially supported by the Russian Science Foundation (Grant No. 21-79-30063).

[1] Boyd R W, Gehr R J, Fischer G L and Sipe J 1996 *Nonlinear optical properties of nanocomposite materials* vol 5 (IOP Publishing)

[2] Gertsvolf M, Jean-Ruel H, Rajeev P P, Klug D D, Rayner D M and Corkum P B 2008 *Physical Review Letters* **101** 243001

[3] Krasin G K, Stsepuro N G, Martovitsky V P and Kovalev M S 2022 *Optics and Spectroscopy* **130** 404