

Localization and amplification of light in the explosion of porous-silicon-based composite

Zegrya G G¹, Shashkov E V², Karpova A A^{1,®},
Vorobiev N S², Freiman V M¹, Zegrya A G¹ and
Solomonov Yu S³

¹ Ioffe Institute, Polytekhnicheskaya 26, Saint-Petersburg 194021, Russia

² Prokhorov General Physics Institute of the Russian Academy of Sciences, Vavilova 38, Moscow 119991, Russia

³ Federal State Unitary Enterprise “Moscow Institute of Thermal Technology”, Berezovaya 10, Moscow 127273, Russia

® va7059va@yandex.ru

Making silicon porous enables the creation of composite materials. Optically ignited, such composites show wavelength sensitivity and fast response. However, the explosion flash kinetics, especially at the period after reaching the maximum flash intensity, and its spectrum are still insufficiently explored. We demonstrate, that porous-silicon-based composites with perchlorate oxidizers exhibit a non-monotonic behavior of the explosion flash intensity. Approximately a millisecond after the explosive reaction start, the flash intensity plummets to zero for tens of microseconds, followed by simultaneous excitation of light and electromagnetic pulses. By changing the oxidizer, we found that a spectral position of light pulse 590 nm is independent of the perchlorate type. Our results suggest the unconventional self-formation of a random active medium consisting of silicon nanoparticles, where the localization and amplification of light may occur.