

MWIR fiber optic pyrometric sensor for studying thermoelectric effects in ferroelectric and semiconductor structures

R. S. Passet¹, L. N. Butvina², A. F. Vakulenko³, G. A. Gavrilov¹,
A. A. Kapralov¹, A. Yu. Molokov¹ and G. Yu. Sotnikova¹

¹ Ioffe Physico-Technical Institute
26 Polytechnicheskaya st., St. Petersburg, 194021, Russia

² Prokhorov General Physics Institute of the Russian Academy of Sciences,
Dianov Fiber Optics Research Center
38 Vavilova st., Moscow, 119991, Russia

³ Peter the Great St. Petersburg Polytechnic University
29 Polytechnicheskaya st., St. Petersburg, 195251, Russia

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An MWIR fiber optic temperature sensor (pyrometer) is presented, designed to monitor the dynamics of temperature changes in samples of ferroelectric materials and small-volume semiconductor structures. The device provides detection of thermal radiation from a section of the surface of an object with a diameter of up to 1 mm with a resolution of no worse than ± 50 mK and a speed of up to 1 ms in the temperature range of 20–200 °C, including directly in the area of laser thermal wave action. The effectiveness of the device is demonstrated by examples of its use to study thermoelectric effects in ferroelectric and semiconductor structures. The set of obtained characteristics is ensured by the use of the latest achievements of the domestic photonics element base – an uncooled spectrally selective IR photodiode, sensitive in the narrow spectral region of 4.2 ± 0.25 μm (developed at the A. F. Ioffe Physicotechnical Institute of the Russian Academy of Sciences) and a fiber-optic circuit for delivering thermal radiation based on IR optical fiber with a high transmittance in the region of 3–12 μm (developed by the E. M. Dianov Scientific Center for Military Studies of the Russian Academy of Sciences).

Keywords: MWIR – temperature sensor; microstructured IR optical fiber; thermoelectric effect; electrocaloric effect.

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