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## Thermal limits of fiber lasers power scaling

Shaidullin R I<sup>1,2</sup>, Ryabushkin O A<sup>1,2</sup> and Ismagilova R I<sup>1</sup> <sup>1</sup>Moscow Institute of Physics and Technology, Russia <sup>2</sup>Kotelnikov Institute of Radio Engineering and Electronics of RAS, Russia

The output radiation power of modern continuous wave single-mode fiber lasers exceeds 10 kW level with radiation intensity in the fiber core more than 10<sup>8</sup> W/cm<sup>2</sup>. Some part of optical pump power, inevitably converts into heat due to the fundamental difference between the pump and generation photon energies, leading to a considerable heating of the active fiber core. A high temperature of the fiber detrimentally affects the laser characteristics and leads to thermal degradation of the fiber, especially its protective polymer layer. Fiber laser filamentous structure results in significant nonuniformity of transverse and longitudinal temperature distribution and high temperature gradients inside the fiber. Therefore, traditional thermal measurement methods don't allow determining distribution of absolute temperature values inside fiber laser. In this study, experimental techniques based on radio-frequency impedance spectroscopy was applied for measurement of active fiber heating. Since dielectric constant of polymer coating of conventional active fibers depends on temperature, then electric impedance of optical fiber is also a function of its temperature. This technique allowed direct measuring of the polymer coating heating, which thermal degradation is one the most limiting factor of fiber laser power scaling. Thermal regime inside entire commercial fiber laser unit was also investigated. Mathematical modeling of thermal processes in fiber laser based on heat conduction equation solution allowed determination of contribution of different mechanisms to the fiber laser heating and temperature distribution inside the fiber laser. All boundary conditions for this modeling were obtained experimentally.

## Biography

Shaidullin R I has completed his PhD from the Institute of Radio Engineering and Electronics of RAS. He is a Senior Researcher at the Institute of Radio Engineering and Electronics of RAS and Lecturer at the Moscow Institute of Physics and Technology. He has published more than five papers in reputed journals and more than 15 abstracts in international conferences.

rs-mipt@mail.ru

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