NUMERICAL OPTIMIZATION OF DUMMY LOADS FOR HIGH POWER MICROWAVE CALORIMETERS

ALEKSEI KLIMOV[1, 2] *AND VASILY KOZHEVNIKOV*[1]

[1]*Institute of High Current Electronics SB RAS*
[2]*Tomsk Polytechnic University, Russia*
klimov@lfe.hcei.tsc.ru

Numerical optimization is performed applied to 1–11 GHz operating band of wide-aperture absorbing loads for calorimeters [*Vykhodtsev P.V., Elchaninov A.A., Klimov A.I. et al. // Instrum. Exp. Tech. – 2015. – V. 58. – No 4. – P. 510.*] intended for high power microwave [*Benford J., Swegle J.A., Shamiloglu E. High Power Microwaves. – New York-London: Taylor & Francis, 2007.*] energy measurements. Calculations are conducted by using gradient-less Nelder-Mead optimization routine w.r.t. two-dimensional axisymmetric load models. We took the reflection coefficient of TM01-mode wave from the input window as an objective function for desired frequency range. Input window relief parameters and the depth of the working fluid are independent parameters of the optimization procedure. Optimization includes the solution of the direct electromagnetic scattering problem. The method is based on finite element method (FEM) for Maxwell's equations in frequency domain in two-axisymmetric coordinate system [*KozhevnikovV.Yu., Klimov A.I. // 13th Intern. Workshop FEM-2016. Florence, Italy, 2016. – P. 170.*]. It allows use of mesh repeating relief of any geometric non-uniformity without significantly increasing of elements density. Frequency dependencies of materials parameters for each material of dummy load (polyamide, polycarbonate, etc.) have been measured experimentally. Metal parts are simulated as perfect electric conductors. For optimized absorbing load the electromagnetic energy losses in the input window were estimated.

This work was supported by Russian Foundation for Basic Research under Project No 14-08-00243-a.

Keywords: *high power microwave, energy measurements, calorimeter.*