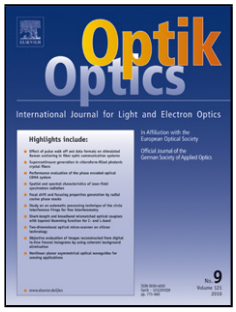

Title: Analytical solutions for three-dimensional modeling of temperature rise inside solid material induced by laser irradiation

Author: Guibo Chen Juan Bi

PII: S0030-4026(16)31590-X
DOI: http://dx.doi.org/doi:10.1016/j.ijleo.2016.12.040
Reference: IJLEO 58670

To appear in:

Received date: 26-10-2016
Accepted date: 10-12-2016

Please cite this article as: Guibo Chen, Juan Bi, Analytical solutions for three-dimensional modeling of temperature rise inside solid material induced by laser irradiation, Optik - International Journal for Light and Electron Optics http://dx.doi.org/10.1016/j.ijleo.2016.12.040

Analytical solutions for three-dimensional modeling of temperature rise inside solid material induced by laser irradiation

Guibo Chen Juan Bi*

(School of Science, Changchun University of Science and Technology,

Changchun 130022, PR China)

*Corresponding author

E-mail: custcb@126.com

Abstract:

In this paper, analytical solutions for three-dimensional(3-D) modeling of temperature rise inside solid material induced by laser irradiation is presented. Firstly, the theoretical physical model of temperature rise for a material surface irradiated by laser is established based on classical heat conduction theory. Then, integral transform method is used to solve the heat conduction equation and its analytical solutions are obtained. In the end, the square and elliptical Gaussian laser beam is selected as examples, and temperature distributions of silicon material irradiated by the two lasers are simulated. Results show that, when silicon material is irradiated by laser, the shape of temperature distributions on the surface of material are similar to that of the laser intensity due to direct absorption mechanism of laser energy on the material surface. The temperature distributions in a certain depth below the material surface also contain the shape information of laser intensity on the material surface.

Keywords: Analytical solutions; Laser heating; Three-dimensional modeling; Temperature rise