Amendments of weld formation in human skin laser soldering

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Abstract

A computational modeling is employed for quantitative assessment of weld formation and area of tissue temperature necrosis during the human skin laser soldering. The evaluation is carried out depending on the components composition of using solders, including bovine serum albumin (BSA), indocyanine green (ICG), and carbon nanotubes (CNT), as well as the angle of incidence of laser light and its pulse duration. The influence of CNT on the change of thermodynamic characteristics of albumin denaturation and the rate of formation of the laser weld is investigated. The obtained results suggest to limit the duration of laser light pulse by temperature relaxation time to minimize transfer of thermal energy to reduce the heating of human skin tissues. The developed model has a great potential for further optimization of laser soldering of biological tissues technology with greater efficiency in minimizing the weld area.

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