THERMAL THERAPY WITH METAL NANOPARTICLE ASSISTED LASER HEATING

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ABSTRACT. Nanoparticle assisted photo thermal therapy (PTT) is a field of nanomedicine that is designed to address the nonselective challenges of conventional laser therapy. Plasmonic photothermal therapy (PPTT), a subfield of PTT is under development for tumor treatment, in which embedded metal nanoparticles absorb the NIR laser light intensely through resonant optical excitation and subsequent heat generation. The main goal of PPTT is to deliver with precision the specified does of energy to the tumor while avoiding any amount to the healthy tissue and nearby at risk organs. Although experimental investigation would be the primary tool to explore the medical applications of nanoparticles, it is also well appreciated that numerical investigations based on modeling and simulations could be useful in accelerating the whole research process. The purpose is to seek therapy with a comprehensive treatment plan aided with fast and accurate numerical simulations as well. The computational tools hope to bridge across the scales from nano to macro, and compare the predicted behavior of a large number of nanoparticles embedded in tissue. Since PPTT cannot penetrate enough to treat deepseated tumors, researchers have begun to investigate phantom models of nanoparticle assisted laser-induced interstitial thermotherapy (LITT). The diffusing laser applicator is placed inside tumors, enabling a more accurate and efficient delivery of energy doses to targeted sites. The following review is on the various geometries of plasmonic nanomaterials (including nanoshells, nanocages, nanorods, and magnetoplasmonic nanostructures) with experimental and mathematical models that concern laser treatments.