

Nanooptics and photonics

Heat generated by different shape nanoparticles under the influence of radiation

I.V. Demkovych¹, A.Ya. Barylyak², I.Ya. Yaremchuk¹

¹ *Department of Photonics, Lviv Polytechnic National University,
S. Bandery str. 12, Lviv, 71013, Ukraine.
E-mail: idemkov@polynet.lviv.ua*

² *Danylo Halitsky Lviv National Medical University,
Pekarska Str.69, 79010 Lviv, Ukraine.*

The metal nanoparticles can absorb the energy of electromagnetic fields and converting this energy into heat for transfer into the environment. As a result, at the nanoscale can be observed heating effects. This motivates to use nanoparticles as targeted heat sources in medical therapy and biotechnology [1]. It is important to find the main causes heating of nanoparticles to effectively tuning the heating to a given temperature at which the chemical or physical reactions will occur. The total amount of heat generated depends on the size and shape of the nanoparticles and summed up in case of the nanoparticles array [2].

In the present work the model which enables to use of separate nanoparticle as a local and selected source of the temperature for molecules or other particles has been proposed. Although, heat is localized in the vicinity of nanoparticles, in the most possible cases, the distribution of temperature field is uniform across the plane of the material which contains nanoparticles exposed the electromagnetic excitation. The gold nanoparticles with radii of 20 nm and 40 nm and nanorods with size 50x150 nm in water have been researched. Calculations have been carried out using parameters as follows: radiation intensity of $2.82 \cdot 10^6$ W/m², wavelength of 532 nm, temperature of medium of 293.15 K, medium absorption of 1.8 m^{-1} , and radiation pulse duration 1 ms.

1. *Govorov, A. O., Richardson, H. H.* Generating heat with metal nanoparticles. // Nano today.-2007.-2, N 1.-P. 30-38.
2. *Baffou, G., Quidant, R., Girard, C.* Heat generation in plasmonic nanostructures: Influence of morphology // Applied Physics Letters. -2009.-94, N 15.-P. 1-3.