MAGNETIC HEATING BY TUNABLE ARRAYS OF NANOPARTICLES IN CANCER THERAPY

Vitalii Zablotskii, Oleg Lunov and Cristina Gômez-Polo

Departamento de Fisica, Universidad Publica de Navarra, 31006, Pamplona, Spain

Detailed knowledge about the temperature distribution achieved in the target area is essential for the development of magnetic hyperthermia treatments. However, the temperature inhomogeneity was found in all local hyperthermia studies. As a consequence of the impossibility of guaranteeing the temperature and thus the thermal dose distribution, hyperthermia is never applied as a single treatment modality. We suggest a model that enables the calculations and optimization of the spatial-time distribution of the temperature in the target volume (i.e. tumor) caused by magnetically heated elements: i) arrays of clusters of iron oxides magnetite (Fe_3O_4) magnetic nanoparticles (MNPs), and ii) arrays of magnetic needles. In order to find the spatial-time temperature distribution in tumor, the bioheat transfer equation is solved for the two above mentioned arrays of magnetically heated sources embedded in tumor. The temporal and spatial temperature distributions were calculated with regards to the effect of blood perfusion in tumor. It is shown that a matrix of magnetic micro-needles injected in tumor could provide rather uniform tumor heating with the center-edge temperature difference less than 3oC at any times during the magnetic hyperthermia treatments. The temperature profiles can be suitably adjusted by a proper choice of the MNPs arrangement.

9.7 cm

13.4 cm

Subject category :

8. Other Topics

Presentation mode :
oral

Corresponding author :
V. Zablotskii

Address for correspondence :
Departamento de Fisica, Universidad Publica de Navarra, 31006, placeCityPamplona, country-regionSpain

Email address :
zablot@fzu.cz