Thermal (rf) and non-thermal mechanisms of nanoparticles induced/enhanced cancer cell apoptosis JAREK WOSIK, University of Houston, DHIYA KETHARNATH, University of Missouri Kansas City, MATTHEW J. WARE, BIANA GODIN, The Methodist Hospital Research Institute, WANDA ZAGOZDZON-WOSIK, University of Houston — It was demonstrated that the rf procedures can be non-invasive and cancer selective when combined with nanoparticles (NPs) that work as rf heating enhancers. However, there are disparities, between theory and experimental results, especially for non-magnetic NP. Therefore, it is necessary to elucidate the physical mechanisms that control the reported rf heating. We have constructed an apparatus for rf heating, which allows for applying either $E_{rf}$ or $H_{rf}$ fields in the kHz-MHz frequency range. Our results of specific absorption rate (SAR) measurements for both magnetic and nonmagnetic of NPs indicate that rf electric field also plays the role in heating of magnetic NPs and that in the nonmagnetic case only interface losses are responsible for the observed heating. In search for a more efficient and non-thermal method, we have explored a cancer cell death through mechanical stress imposed on the cell membrane. We have designed a special setup to apply either static or ac magnetic fields/gradients (up 300T/m) to cultured cancer cell lines with/without PNs added. The fields and gradients, and forces applied were simulated using HFSS/Maxwell software. Pancreatic adenocarcinoma cell line, AsPC-1 stained with DRAQ7 were studied. Very strong dependence of number of dead cells on applied field strength was observed. Discussion of the two mechanisms (rf and non-rf) of observed apoptosis will be presented.

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