First results on improving the efficacy of magnetic hyperthermia using non-sinusoidal alternating magnetic field waveforms

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Abstract: Recently, efforts have been made to improve the efficacy of particle-mediated magnetic hyperthermia by modifying the waveforms of electromagnetic radiation. Theoretical studies[1,2] propose that trapezoidal waves can improve the thermal power generated with respect to that explained by the classical model for sinusoidal waves[3]. Experimental advances based on new equipment implementing non-sinusoidal waves have also led to some promising results[4,5,6,7]. The first results obtained so far on in vitro samples, on thermal power characterization experiments to study the thermal efficiency of non-sinusoidal stimulation (Figure 1, 2) and on efficiency characterization experiments in cell cultures with cancer cell lines are presented. Although the data obtained are promising, it is also concluded that it is necessary to progress in the understanding of the thermal dissipation phenomenon with non-sinusoidal signals, as well as to improve the prototypes themselves to achieve greater flexibility and power. The most promising avenues for improvement are discussed.

References

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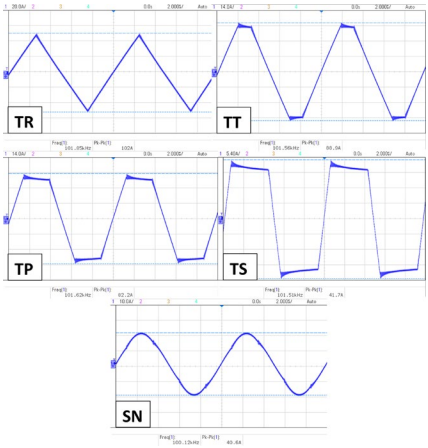
Figures



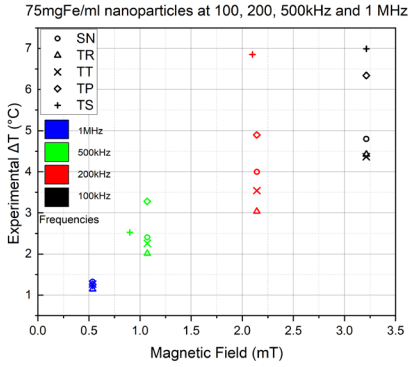


Figure 2: Comparing the 900 second experiment results of all signals at 0.53, 1.07 (except for TS at 0.890), 2.14 and 3.21 mT and 1 MHz, 500, 200 and 100 kHz frequency, respectively.