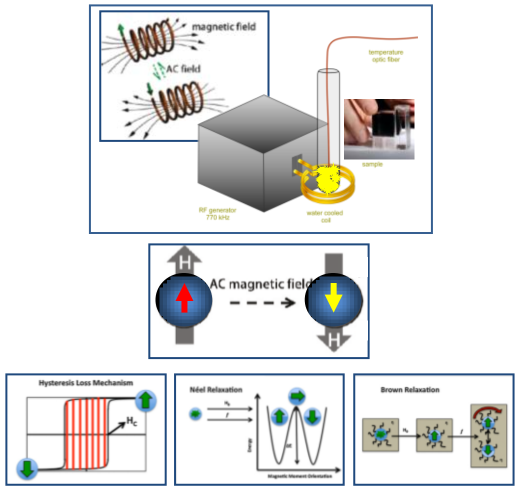

Loss mechanisms that contribute to AC heating response of magnetic nanoparticles

Three typical ferromagnetic nanoparticle systems were studied in the present work as alternate magnetic hyperthermia agents. In an effort to examine the influence of room-temperature ferromagnetism on the heating efficiency of magnetic carrier, we studied the $Nd_2Fe_{14}B$, the FePt and MFe_2O_4 (where M=Co or Mn). For the first one, a top – down synthesis process (ball-milling) was followed, while for the other two the thermal decomposition technique, using appropriate precursors and surfactants (e.g. oleylamine) per case, were used.

X-ray diffraction (XRD) measurement and transmission electron microscopy (TEM) imaging were used to verify the obtained crystal structure and the actual particles size. Magnetic properties were evaluated by vibrating sample magnetometry (VSM) and by superconducting quantum interference device (SQUID), in order to record hysteresis loops and ZFC-FC selectively and to confirm the existence of either superparamagnetism or ferromagnetism at room temperature and corresponding transition thresholds..

Magnetic hyperthermia curves were taken by subjecting nanoparticles dispersions at different *AC* magnetic fields as well as at different concentrations. The magnetically hard $Nd_2Fe_{14}B$ nanoparticles were found to have the best performance (namely the NFB40 sample) relative to the other systems studied here. The FePt nanoparticles have not yield the expected results based on the literature, mostly due to their unordered cubic crystal structure. We have observed the direct dependency of the *SLP* from the concentration of the solution regarding the MFe_2O_4 (M=Co or Mn) system, the *SLP* ratio increased as the concentration decreased.

The parameterization of thermal response played an important role in this dissertation, by measuring temperature variations and estimated *SLP* (Specific Loss Power) values to provide quantifiable values of heating efficacy. In general, the temperature rise was found to be proportional to the intensity of the applied magnetic field, while the solution concentration and the nanoparticle size were key parameters to this work. Eventually, alternate magnetic heating carriers may be employed selectively in order to enhance the heating efficacy just by tuning the ferromagnetic features of their entities.