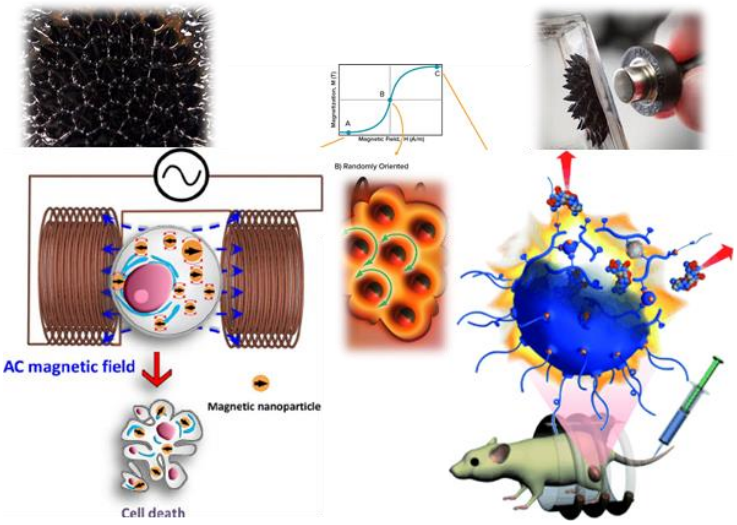
ABSTRACT



Magnetic particle hyperthermia is a synergistic cancer treatment that takes advantage of heat released by magnetic nanoparticles (MNPs) when exposed in an alternating magnetic field and may lead cancer cells either to a severe shock or even to apoptotic death. The thermal response of MNPs solution depends on a large number of parameters, such as the intrinsic properties of nanoparticle (e.g. size, anisotropy, magnetization) and the field parameters (amplitude, frequency). The present thesis aims to optimize a method for fighting cancer using the benefits of nanotechnology and material's science. The method which is under study is called magnetic hyperthermia and is av alternative, promising method than can be used additionally to other methods of fighting cancer, such as chemotherapy, radiotherapy and surgery. The basic principles of magnetic hyperthermia is the destruction of cancer cells using magnetic nanoparticles, which change their magnetization under an alternating magnetic field and therefore, produce heat. The key to magnetic hyperthermia is to find the most efficient material to construct the magnetic nanoparticles. Such a system should be both heat efficient and biocompatible.

The research that has been conducted, aimed in finding magnetic nanoparticles suitable for magnetic hyperthermia method. To achieve that, 5 samples fabricated in Centre national De La Recherche Scientique (CNRS-Promes) in France have been tested. The synthesis method was solar vapor deposition, a facile route to collect big quantities of nanoparticles, yet without protective surfactants. Various systems were selectively examined such as combinations of Fe and Co with the respective oxides and with noble metals. All samples under study undergone X-ray diffraction experiments and corresponding analysis. Static magnetometry was conducted to show the magnetic features of samples such as saturation magnetization, coercivity, remanent magnetization, ingredients necessary for improving heating efficiency. Eventually, the magnetic particle hyperthermia was performed in solutions of varying concentration (1-10 mg/mL) and varying AC fields (frequencies: 375, 765 kHz and amplitudes 30,-60 mT) and the relation of heating efficiency with respect to solution concentration and field parameters is discussed.