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## DESIGN OF BIOCOMPATIBLE MAGNETIC NANORODS FOR HYPERTHERMIA

### INTRODUCTION

Magnetic nanoparticles have attracted much attention during the last few decades due to their potential applications in biomedicine. In the case of hyperthermia, the application of an alternating magnetic field can lead to an increase in temperature up to 42-43 °C leading to the cell death without having any side effects. However, the mechanisms that lead the particles to produce heat are still unclear.

### OBJECTIVE

The objective of the research is the design and synthesis of anisometric (nanorods, nanobars) particles with magnetic properties (magnetite/maghemite). Due to their high axial ratio, magnetic properties are expected to be different than the spherical ones, like for example the increase in shape anisotropy which can cause an increment of the heating effect.

The first step is to synthesize a magnetite precursor with the desired shape like akaganeite ( $\beta$ -FeOOH). The second steps consist on the coating of the particles by silica. Silica will improve the stability of the particles, but also the biocompatibility and avoid sintering in the further reduction step. The final step consists on the reduction of akaganeite into magnetite. Transmission Electron Microscope (TEM), X-Ray Diffraction (XRD), Dynamic light Scattering (DLS) and magnetic measurements are being carried out in order to check the structural, colloidal and magnetic properties of the magnetic nanorods.

### WHY JSPS?

The work I was carrying out at the Department of Physics of The University of York was related with the evaluation and elucidation of the main mechanisms that leads the particles to produce heat under the application of an alternating magnetic field. During this time one gets an idea of the desirable properties which particles should have to be effective for the dissipation of heat. In this sense, JSPS gave me the opportunity to contact with Prof Takahashi (Tohoku University), the group leader of one of the top groups in Synthesis of magnetic nanoparticles of the world. In this sense, JSPS acted as a bridge between me and a top country in research. Also, I have developed my research career in European countries like Spain and United Kingdom so working in Japan gave me the chance to work in a different environment, with a different organization and different way to understand science.

## THE EXPERIENCE

Working in the Takahashi Lab, under the supervision of Prof. Takahashi and Prof. Ogawa is becoming an excellent professional and personal experience. It's remarkable the kindness and friendship of all group members. Scientific discussion with Prof. Takahashi and Prof. Ogawa are very useful to overcome the difficulties and bad days I'm having from a scientific point of view. Also PhD students and technicians are helping me so much for using experimental techniques and Japanese software. During this time we have gained a lot through exchanging ideas about synthesis techniques for magnetic nanoparticles.

In my case it has been called to my attention how big the group is. A huge office for 30 people and 5 different labs with equipment for synthesis and magnetic characterization. Contrary to what one may think because of the size of the group, every day work is not chaotic, Japanese groups in general and this group in particular are very disciplined. They know what they have to do and dedicate time to keep the work going on and as members of a team they help to each other. You realize this in the first few days and it's key to try to help them as much as you can. One of the things in which foreigners can be useful for them is in English. Correcting papers, reviewing, translating.... These small efforts for us are very appreciated by Japanese people. I think is a way to return to them what they give you and a personal/professional relation should work in two directions (give/receive).

Due to the time spent together, a workmate is your friend, so some special events are very helpful to introduce yourself to people (especially karaoke). With the Tribute dinner for Prof. Takahashi's retirement I felt very relax talking to people and meeting new ones.

## LIVING IN JAPAN

All the arrangements before you travel to Japan are usually done by the group. Most of the Japanese research groups have secretaries which are the responsible for doing this so it's key to contact them as soon as you know you are awarded a fellowship to arrange everything like the start and finish date, accommodation and Certificate of Eligibility (if staying longer than 3 months) needed to obtain a VISA. You will soon realize about the kindness of these secretaries so please don't hesitate to ask about any doubts you may have.

When you arrive to Japan and start living there one realizes that everything is written in hiragana, kanji or katakana. Few things are written in romaji and also English so it's better to have during the first days a map of the city in your pocket and identify the bus stops you're your accommodation, university and downtown. Don't miss the chance to rent a bike if you can because it's a usual way for getting around.

