

2021 - Activity Report Summary

During this phase of the project, $\text{Fe}_{68.2}\text{Cr}_{11.5}\text{Nb}_{0.3}\text{B}_{20}$, $\text{Fe}_{66.7}\text{Ti}_{13}\text{Nb}_{0.3}\text{B}_{20}$ and $\text{Fe}_{66.7}\text{Mn}_{13}\text{Nb}_{0.3}\text{B}_{20}$ particles were prepared by mechanically grinding amorphous ribbons. The particles have dimensions ranging from 10 nm to 10 microns, and parallelepiped shapes. Co-Fe, Ni-Fe, Co and Ni nanowires were prepared by electrolytic deposition in porous alumina membranes with different pore diameters. Nanowires with diameters of 200 nm and 35 nanometers and different lengths, ranging between 2 microns and 30 microns, were separated from the dissolved membranes. We performed complex measurements of the specific magnetic characteristics of the magnetic particles and nanowires, necessary to evaluate their suitability for applications for cancer cell destruction by magnetic actuation in low frequency rotating magnetic field.

The results of the measurements showed that both the magnetic particles and the magnetic nanowires, in particular the $\text{Co}_{65}\text{Fe}_{35}$ ones, meet all the necessary conditions for the mentioned application according to the project proposal. The calculation methodology for the torque developed by rotating magnetic particles and nanowires under the action of a rotating magnetic field was established. The evaluation of this torque for concrete cases of particles and nanowires obtained by our group showed that the obtained values are in a good agreement with those mentioned in the literature for other types of material, yet slightly higher due to the higher value of saturation magnetization of materials prepared by our group.

A scientific paper entitled "Magnetic Nanoparticles and Magnetic Field Exposure Enhances Chondrogenesis of Human Adipose Derived Mesenchymal Stem Cells but not of Wharton Jelly Mesenchymal Stem Cells" has been published in the ISI-journal **Frontiers in Bioengineering and Biotechnology, Tissue Engineering and Regenerative Medicine (IF 5)**. The paper "Simple method of preparing biological cell samples for SEM imaging of nanomaterials adhering to the cell membrane" was presented at the **13th International Conference on Physics of Advanced Materials (ICPAM-13)**, Sant Feliu de Guixols, Costa Brava, Spain. The paper "Fe-Co magnetic nanowires for cancer cell destruction by magneto-mechanical actuation" was sent and accepted at the **Joint MMM-INTERMAG 2022** conference, January 10-14, 2022, New Orleans, Louisiana, USA.

The paper "Influence of wet and dry milling conditions on the evolution of microstructure and T_c of Fe-Cr-Nb-B glassy powders" was sent and accepted at **Joint MMM-INTERMAG 2022**, January 10-14, 2022, New Orleans, Louisiana, USA.