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**Electrochemical preparation of Co-Ag  
nanostructured materials for GMR  
applications**

Memòria que presenta JOSÉ MANUEL GARCÍA TORRES per optar al  
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# **CHAPTER 2**

## **OBJECTIVES AND SCHEDULE**

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# 2

## OBJECTIVES AND SCHEDULE

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The present thesis has been mainly developed in the *Laboratori d'Electrodeposició i Corrosió (Electrodep)* in the *Physical Chemistry Department* of the *University of Barcelona* under the supervision of Dra. Elvira Gómez and Dra. Elisa Vallés. Part of this thesis was carried out in the *Electrodeposited Nanostructures* group in the *Research Institute for Solid State Physics and Optics* in Budapest during a four-month research stay and under the supervision of Dr. Imre Bakonyi and Dr. László Péter.

This thesis mainly focuses on the research around the electrochemical technology as an alternative to prepare different kinds of Co-Ag nanostructured materials with the magnetoresistance effect. Among those materials, granular films, multilayers and nanowires were prepared taking profit of the versatility of the electrodeposition against other more expensive techniques to prepare such different nanostructured materials. It was also of interest to prepare Co-Ag nanoparticles by a chemical method in order to compare the properties of Co-Ag materials obtained under different configurations (granular films, multilayers, nanowires and nanoparticles). The specific objectives raised in this thesis are:

- Basic study of the electrodeposition process of the Co-Ag system in different electrolytic baths and analysis of the viability of the different electrolytes to prepare the materials. Preparation of the granular films, multilayers and nanowires based on the previous electrochemical results. Preparation of Co<sub>Core</sub>-Ag<sub>Shell</sub> nanoparticles by the microemulsion method.
  
- Study of the influence of the electrodeposition/preparation conditions on the properties of the Co-Ag nanostructured materials (morphology, composition, crystalline structure, magnetic properties,...) and analysis of the relationship among those properties

- Study of the factors that govern the magnetotransport properties and optimization of the electrodeposition/preparation conditions to maximize the magnetoresistance values in the different classes of nanostructures. Interpretation of the magnetoresistance values obtained on the basis of the microstructure/nanostructure of the different kinds of materials prepared.

The present thesis is organized as follows. Chapter 3 summarizes the techniques employed to prepare the different classes of nanostructured materials as well as the techniques used to characterize them. In Chapter 4 the results concerning the growth and characterization of granular films will be presented. Important results about the magnetoresistance effect will also be discussed. Chapter 5 will be devoted to the preparation of magnetic/non-magnetic multilayers and the characterization of the structural and magnetotranport properties. The results concerning the preparation and characterization of nanowires and nanoparticles will be shown in Chapter 6 and Chapter 7, respectively. Chapter 8 will briefly summarize the main conclusions drawn in this thesis. Future directions to improve the characteristics of the nanostructured materials reported here are given in the corresponding chapter.