Nuclear Magnetic Resonance in Ferromagnetic Materials: Correlating the Structure and Morphology of Thin Films, Multilayers and Nanocomposites to their Physical Properties

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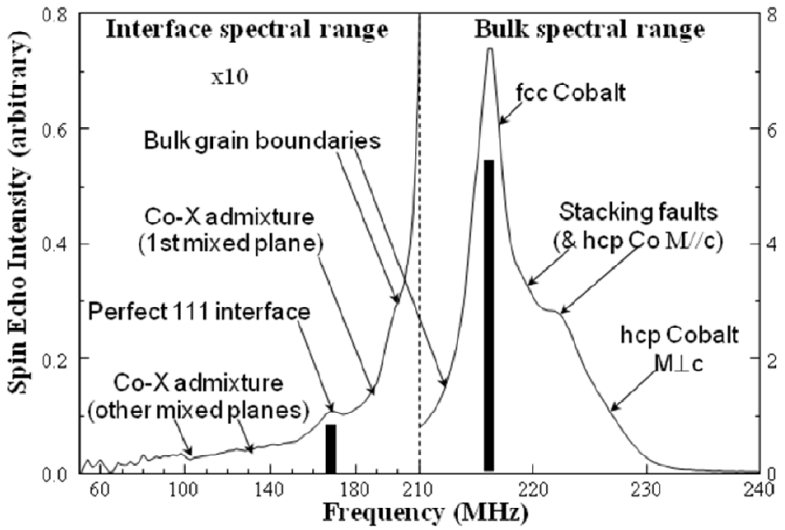
Nuclear Magnetic Resonance (NMR) is a technique that is very commonly used in medicine, chemistry or biology, but it is much less used to study ferromagnetic materials. However when used to study ferromagnetic materials, it has the ability to provide, simultaneously and at the same scale, information about the local structure as well as about the local magnetic properties of the probed atoms. In the first part of this talk I will present the basis of NMR and more particularly I will point out the particularities of the technique when it is used to study ferromagnetic materials. As an example the NMR spectrum of a Cobalt thin film is shown in the following figure: The high frequency side shows the NMR sensitivity to the bulk crystallographic structure of Co (cubic, hexagonal and stacking faults) while the low frequency side shows the sensitivity of NMR to the Co chemical environment (interfaces with the neighbouring layers). In addition to these structural information, magnetic information for each local environment observed in the NMR spectrum can also be obtained. For this purpose we have developed 3D NMR1 in ferromagnets to visualise simultaneously the structural and the magnetic in-homogeneities into the studied samples. The magnetic information is recorded in the form of a local magnetic susceptibility (or more exactly a local magnetic stiffness: ~1/c). A detailed description of this aspect of NMR will be given during the talk. In the second part of this presentation I will give examples of studies of thin films, multilayers, and nano-composites taken from very different research fields: Thin films for magnetic [1] and optical[2] applications, supported Co particles for catalyses[3]...



참고문헌

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