MAGNETOIMPEDANCE, FERROMAGNETIC RESONANCE, AND LOW-FIELD MICROWAVE ABSORPTION IN AMORPHOUS FERROMAGNETS

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Magnetoimpedance (MI), i.e., the variations in impedance of a ferromagnetic conductor (traversed by an AC current) when subjected to a DC magnetic field, has been intensely investigated un the recent years due to its wide applications in magnetic field and electric current sensors. For many applications, the efficiency increases as the working frequency increases; the natural limit seems to be ferromagnetic resonance (FMR). However, MI is an essentially different phenomenon than FMR. The latter is a quantum-mechanical phenomenon which should satisfy the Larmor equation, while MI extends continously from some hundreds of kHz up to the GHz range.

A new phenomenon, which appears at very low fields in FMR experiments (and needs a special accessory to compensate the remanence of electromagnets and accurately measure very low magnetic fields), led to a clear difference between MI and FMR. This microwave interaction, which we call "low-field absorption" (LFA), has shown a strong similarity with MI, as far as it is controlled by the anisotropy field [1]. In this work, we show the characteristics of LFA for some selected amorphous materials, such as ribbons, microwires, and thin films. In particular, for Co-rich microwires, we show the beginning of the splitting between MI and FMR at frequencies ~ 200 MHz, and the full differentiation between LFA and FMR at 9.4 GHz. LFA and GMI have many common features.