

Microwave Characterization of Magnetic Nanowires for Use in Nanomedicine Applications

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ABSTRACT — In healthcare, microwave technology has been used in diagnostics and therapy for imaging and ablation for some time. Advances in nanotechnology, however, introduce new opportunities in the microwave field. Nanotechnology advances offers the potential to provide site-specific drug delivery using non-magnetic nanoparticles; whereas magnetic nanoparticles can be used for nano-heating at low RF frequencies. Nanowires can also be used as a tool in nanomedicine and some have unique microwave and millimeter wave properties. Recently, we have shown that magnetic nanowire technology has the potential to be used as biolabels. Each material (Fe, Co, and Ni) has a unique ferromagnetic resonance (FMR) behavior that can be detected in the microwave and millimeter wave regime. Thus, different magnetic nanowire (Fe, Co and Ni) materials can be detected as individual sets of nanowires or as combinations.

This talk will highlight research done to characterize the microwave response of different magnetic nanowire materials using vector network analyzer. It will discuss the

characterization approach used to determine the FRM of individual magnetic materials and combinations of materials. These experiment are needed to establish a framework for detecting mixtures of nanowires that is promising for use as labels in the study of disease. So far, these characterization methods are the initial steps to developing unique labels that can eventually allow for simultaneous detection of different cell systems. It is also the first step to enabling development of a parallelized bio-label system approach with magnetic nanowires.

Index Terms — magnetic nanowires, ferromagnetic resonance, vector network analyzer, biolabels.

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