Advances in Ferrite Design, Processing, and Packaging Towards Miniature Microwave Components

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Ferrite materials have long played an important role in power conditioning, conversion, and generation across a wide spectrum of frequencies. They remain the preferred magnetic materials, having suitably low losses, for most applications above 1 MHz, and are the only viable material for magnetic microwave and millimeter wave devices.

Recently, novel processing techniques have lead to a resurgence of interest in the design and processing of ferrite materials. These latest developments have set the stage for their innovative use in monolithic microwave integrated circuits (MMIC), magnetodielectric composite structures and substrates, and in negative index metamaterial media and NIMtronics elements. Recent developments point to cost-effective, miniature, and passive components for next generation radar systems. As nanoparticles, they play an important role in emerging technologies that include cancer remediation therapies, targeted drug delivery, and enhanced magnetic resonance imaging,

In this lecture, we will explore recent advances in the design, processing, and application of ferrite materials as nanoparticles, nanocomposites, films, single crystals and metamaterials. Novel demonstrations include self-biased ferrite structures leading to the miniaturization of radar electronics, the first demonstration of a microstrip NIM phase shifter, and the first integration of ferrite films with wide bandgap semiconductor materials suitable for microwave integrated circuit applications.

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