The Characteristics of Millimetre-wave Gyrotropic Magnetic Material for Use in Quasi-optical Non-reciprocal Devices

B. Yang, **R. S. Donnan**, and **D. H. Martin**
Queen Mary, University of London, UK

Ferrites materials are employed in many millimetre-wave and sub-millimetre-wave applications such as radar, imaging, communications, electron spin resonance and precision measurement. The use of quasi-optical techniques are preferable for millimetre-wave systems over waveguiding for the propagation and manipulation of signals as they afford low power losses, wide bandwidths and high power handling capabilities.

Large numbers of quasi-optical Faraday rotators utilize magnetically soft ferrite material. These devices are biased by using large external magnets. Quasi-optical Faraday rotators that used permanently magnetized ferrites were first examined by Martin et al. [1] who surveyed a number of ferrites and produced an isolator with 17 dB isolation and 1.0 dB insertion loss at 115 GHz. This work was extended and improved upon by Webb [2] who produced W-band isolators having 30 dB isolation and an insertion loss of < 0.5 dB.

The objective of our research is to focus on selecting magnetically-hard ferrite materials, which are ideally suited to operate in high frequency (> 90 GHz) quasi-optical non-reciprocal devices.

In this paper we present the static magnetic characteristics of a candidate material, which is suited for use in high-performance non-reciprocal device operating at frequency above 90 GHz. Further, we theoretically examine the determination of a ferrite's magneto-optical constants from complex amplitude reflectance and transmittance measurements, and assess the stability of such determinations upon measurement practice.

REFERENCES

1. Wylde, R. J., "Gaussian beam-mode circuits for millimetre wavelengths," Ph.D. Thesis, Queen Mary University of London, 1985.
2. Webb, M. R., "Millimetre wave quasi-optical signal processing systems," Ph.D. Thesis, St Andrews, 1992.