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Frequency dependence of Verdet constant of Bismuth-Doped Rare-Earth Iron Garnets for Magneto-Optic Sensor Applications MANNIX SHINN, U.S. Naval Research Laboratory, RONGJIA TAO, Temple University, DONG HO WU, ANTHONY GARZARELLA, U.S. Naval Research Laboratory —
There is growing interest in applying magneto-optic materials toward sensor applications. One of these applications is to exploit the Faraday Effect to measure magnetic fields. Bismuth-doped rare-earth iron garnets have proven to be highly sensitive Faraday rotators, but their frequency response and dynamic range to magnetic fields require further study. The Faraday Effect was studied in two samples of bismuth-doped rare-earth iron garnets grown in different conditions, and experiments were performed in a static field as well as in a RF field. Static magnetic fields up to 3 kG were used, and we found that the Faraday rotation became saturated at high fields, indicating that the field dependence follows the hyperbolic tangent function. We extracted each sample's Verdet constant from the Faraday rotation at low magnetic fields of < 0.1 kG. These experiments were repeated using different laser probe beam wavelengths, ranging from 405 nm to 2000 nm. We measured the transmission coefficient and the Verdet constant for each sample for different probe beam wavelengths and for an external magnetic field at various frequencies. We will discuss the implication of our experimental results.

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