Reflection Beam Isolator

for Submillimeter Wavelengths

M. Kanda

Abstract

The purpose of this paper is to discuss magnetoplasma reflection beam isolators for use at submillimeter wavelengths. The basic configuration used is that of the Kerr transverse magneto-optical effect. Theoretical and experimental data at 337 μm using InSb as a plasma medium are given.

Introduction

Experiments were performed at 337 μm using n-type InSb as the plasma. The dielectric layer was a high density polyethylene film. The block diagram of the experimental apparatus for the measurement of the far-infrared non-reciprocal reflection is shown in Fig. 2.

General Discussion

The theoretical and experimental reflection loss from the interface between free space and dielectric coated InSb at 284 K are shown in Fig. 3 for the dc magnetic field of 15 kG as a function of incident angle, and in Fig. 4 at a fixed angle of 65° as a function of dc magnetic field. The general shapes of the curves for the theoretical and experimental results agree fairly well except at large incident angles. Errors are accounted for by the experimental system used.

Conclusion

The theoretical and experimental investigations in this paper were performed to develop a reflection beam isolator for submillimeter wavelengths using non-reciprocal reflection of electromagnetic waves incident on a solid state magnetoplasma (Kerr transverse magneto-optical effect, as shown in Fig. 1).

Calculation of Reflection Coefficient

Calculation of Reflection Coefficient

The reflection coefficient R is derived for the interface between free space and a dielectric coated magnetoplasma as shown in Fig. 1 using a transmission line impedance method. If the plasma is lossless, there will be a change of phase but no change in the magnitude of R upon reversal of direction of propagation. However, with loss in the magnetoplasma, the reflection coefficient R is found to be non-reciprocal.

References


University of Colorado, Department of Electrical Engineering, Boulder, Colorado 80302.

This work was supported by NASA Grant No. NGLO6-003-088.
Fig. 1: Orientations of Field Vector $E$, Propagation Vector $\vec{n}$, and dc Magnetic Field $\vec{B}$

Fig. 2: Block Diagram for IR Experimental Set-up

Reproduced from original page. Original page is poor.

Fig. 3: Theoretical and Experimental Reflection Loss of InSb at 337 μm as a Function of Incident Angle

Fig. 4: Theoretical and Experimental Reflection Loss for InSb at 337 μm as a Function of Magnetic Field