Optical Permittivity and Permeability in the THz Band

from Independent Measurements of Normal Transmission and Reflection

Gian Paolo Papari1,2,3, Zahra Mazaheri1,3, Francesca Lo Presti,4 Anna Lucia Pellegrino4, Graziella Malandrino4 and Antonello Andreone1,2,3

1Dipartimento di Fisica, Università di Napoli “Federico II,” via Cinthia, I-80126 Napoli, Italy

2CNR-SPIN, UOS Napoli, via Cinthia, I-80126 Napoli, Italy

3Istituto Nazionale di Fisica Nucleare (INFN), Naples Unit, via Cinthia, I-80126 Napoli, Italy  
4Dipartimento di Scienze Chimiche, Università di Catania, and INSTM UdR Catania, Viale A. Doria 6,

I-95125 Catania, Italy;

An accurate retrieval procedure has been developed in order to extract both the dielectric and magnetic response of thin and thick samples in the THz band. Differently from a previous approach [1], the exact expressions of the complex reflection and transmission of the THz beam normally impinging on the sample surface are used. The core of the methodology consists in the independent employment of the experimental and values, processed by a total variation technique [2] to retrieve the complex impedance and refractive index , namely , , . From here the dielectric function and permeability are obtained through , () to achieve , , , . The technique is applied to a thin film of BiFeO3 showing a small but finite magnetization and a phononic resonance at about 2 THz [3]. The BiFeO3 films have been grown on quartz, following a procedure similar to that previously optimized for the deposition on Si (100) substrate [4]. In particular, the films have been deposited in the temperature range 600–800 °C for 60 min using the Bi(phenyl)3 and Fe(tmhd)3 (phenyl = –C6H5, H-tmhd = 2,2,6,6-tetramethyl-3,5-heptandione), as precursors. The X-ray diffraction patterns, recorded in grazing incidence mode (0.8°), have confirmed the formation of pure, polycrystalline BiFeO3 films, while the field emission scanning electron microscopy image indicates the presence of grains of about 500-600 nm.

References

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