214
Accession number:20123215307570
Title:High-resolution terahertz optical absorption study of the antiferromagnetic resonance transition in hematite (α-Feinf2/infOinf3/inf)
Authors:Chou, Shin G. (1); Stutzman, Paul E. (2); Wang, Shuangzhen (2); Garboczi, Edward J. (2); Egelhoff, William F. (3); Plusquellic, David F. (1)
Author affiliation:(1) Physical Measurement Laboratory, National Institute of Standards and Technology, Gaithersburg, MD 20899, United States; (2) Engineering Laboratory, National Institute of Standards and Technology, Gaithersburg, MD 20899, United States; (3) Material Measurement Laboratory, National Institute of Standards and Technology, Gaithersburg, MD 20899, United States
Corresponding author:Chou, S.G.(shinchou@alum.mit.edu)
Source title:Journal of Physical Chemistry C
Abbreviated source title:J. Phys. Chem. C
Volume:116
Issue:30
Issue date:August 2, 2012
Publication year:2012
Pages:16161-16166
Language:English
ISSN:19327447
E-ISSN:19327455
Document type:Journal article (JA)
Publisher:American Chemical Society, 2540 Olentangy River Road, P.O. Box 3337, Columbus, OH 43210-3337, United States
Abstract:We report high-resolution optical absorption measurements between 1.5 and 10 cmsup-1/sup of the antiferromagnetic (AFM) resonance transition in α-Feinf2/infOinf3/inf. The AFM transition is measured over a range of temperatures from 4 to 325 K that includes the low- and high-temperature branches separated by a magnetic phase transition near 260 K. The high-resolution measurements devoid of optical interference were made possible by improving the frequency stability of the near-infrared lasers used to generate terahertz radiation (±0.0003 cmsup-1/sup) and by taking advantage of the large temperature dependence of the AFM transition frequency. The temperature dependence of both branches could be well-fit to a magnon model. A slight difference in temperature dependence between the hematite samples with different annealing treatments was observed in the low-temperature branch. The difference is qualitatively explained by changes in the higher order crystalline anisotropy energy resulting from slightly altered magnetic interactions due to the annealing treatment. The sensitivity achieved using these methods permits a detailed characterization of the optically excited AFM magnon in the absence of magnetic fields over a wide temperature range, thus making the terahertz-based optical platform suitable for nondestructive examination applications for many AFM materials and devices. 
Number of references:41
Main heading:Hematite

Controlled terms:Antiferromagnetism - Light absorption - Nondestructive examination - Temperature distribution
Uncontrolled terms:AFM - Annealing treatments - Antiferromagnetic resonance - Antiferromagnetics - Crystalline anisotropy - High resolution - High temperature - High-resolution measurements - Low temperatures - Magnetic interactions - Magnetic phase transitions - Near-infrared lasers - Optical absorption measurement - Optical absorption studies - Optical platforms - Resonance transition - Temperature dependence - Temperature range - Tera Hertz - Terahertz radiation - Transition frequencies
Classification code:421 Strength of Building Materials; Mechanical Properties - 482.2 Minerals - 641.1 Thermodynamics - 708.4 Magnetic Materials - 741.1 Light/Optics
DOI:10.1021/jp3036567
Database:Compendex