15
Accession number:20123215326110
Title:Carrier density dependence of the nonlinear absorption of intense THz radiation in GaAs
Authors:Sharma, G. (1); Al-Naib, I. (1); Hafez, H. (1); Morandotti, R. (1); Cooke, D.G. (2); Ozaki, T. (1)
Author affiliation:(1) INRS-EMT, 1650 Boul. Lionel-Boulet, Varennes, QC J3X 1S2, Canada; (2) Department of Physics, McGill University, Montreal, QC H3A 2T8, Canada
Corresponding author:Sharma, G.
Source title:Optics Express
Abbreviated source title:Opt. Express
Volume:20
Issue:16
Issue date:July 30, 2012
Publication year:2012
Pages:18016-18024
Language:English
E-ISSN:10944087
Document type:Journal article (JA)
Publisher:Optical Society of America, 2010 Massachusetts Avenue NW, Washington, DC 20036-1023, United States
Abstract:We study the carrier density dependence of nonlinear terahertz (THz) absorption due to field-induced intervalley scattering in photoexcited GaAs using the optical-pump/THz-probe technique. The intervalley scattering in GaAs is strongly dependent on the photo-carrier density. As the carrier density is increased from 1 × 10sup17/sup to 4.7 × 10sup17/sup cm sup-3/sup, the nonlinear absorption bleaching increases. However, if the carrier density is increased further above 4.7 × 10sup17/sup cm sup-3/sup, the trend reverses and the bleaching is reduced. The initial increase in absorption bleaching is because, unlike low THz field, high THz field experiences intervalley scattering and nonparabolicity of the conduction band. On the other hand, a simple electron transport model shows that the reduction in intervalley scattering is mainly due to the increase in the electron-hole scattering rate with the increase in the carrier density. This increase in the electron-hole scattering rate limits the maximum kinetic energy attainable by the electrons and thus reduces the observed nonlinear absorption. © 2012 Optical Society of America.
Number of references:37
Main heading:Carrier concentration
Controlled terms:Electron scattering - Gallium arsenide - Semiconducting gallium
Uncontrolled terms:Absorption bleaching - Density dependence - Electron transport - Electron-hole scatterings - Field-induced - GaAs - Intervalley scattering - Non parabolicity - Nonlinear absorptions - Photocarrier - Terahertz - THz fields - THz radiation
Classification code:712.1.1 Single Element Semiconducting Materials - 804 Chemical Products Generally - 931.3 Atomic and Molecular Physics
DOI:10.1364/OE.20.018016
Database:Compendex