156
Accession number:20123015283188
Title:Temperature enhancement of terahertz responsivity of plasma field effect transistors
Authors:Klimenko, Oleg A. (1); Knap, Wojciech (1); Iniguez, Benjamin (3); Coquillat, Dominique (1); Mityagin, Yury A. (2); Teppe, Frederic (1); Dyakonova, Nina (1); Videlier, Hadley (1); But, Dmitry (1); Lime, Francois (3); Marczewski, Jacek (5); Kucharski, Krzysztof (5)
Author affiliation:(1) UMR 5221, CNRS, University Montpellier 2, Montpellier 34095, France; (2) P. N. Lebedev Physical Institute of RAS, Moscow 119991, Russia; (3) Department of Electronic, Electrical and Automatic Control Engineering, Universitat Rovira i Virgili, Tarragona 43007, Spain; (4) Department of Applied Physics, Tokyo University of Agriculture and Technology, Tokyo 184-8588, Japan; (5) Institute of Electron Technology, Warsaw 02-668, Poland
Corresponding author:Klimenko, O.A.
Source title:Journal of Applied Physics
Abbreviated source title:J Appl Phys
Volume:112
Issue:1
Issue date:July 1, 2012
Publication year:2012
Article number:014506
Language:English
ISSN:00218979
CODEN:JAPIAU
Document type:Journal article (JA)
Publisher:American Institute of Physics, 2 Huntington Quadrangle, Suite N101, Melville, NY 11747-4502, United States
Abstract:Temperature dependence of THz detection by field effect transistors was investigated in a wide range of temperatures from 275 K down to 5 K. The important increase of the photoresponse following 1/T functional dependence was observed when cooling from room temperature down to 30 K. At the temperatures below ∼30 K, the THz response saturated and stayed temperature independent. Similar behavior was observed for GaAs, GaN, and Si based field effect transistors. The high temperature data were successfully interpreted using recent theory of overdamped plasma excitation in field effect transistors. The low temperature saturation of the photoresponse was tentatively explained by the change of the transport regime from diffusive to ballistic or traps governed one. Our results clearly show that THz detectors based on field effect transistors may improve their responsivity with lowering temperature but in the lowest temperatures (below ∼30 K) further improvement is hindered by the physics of the electron transport itself. © 2012 American Institute of Physics.
Number of references:21
Main heading:Field effect transistors
Controlled terms:Gallium nitride
Uncontrolled terms:Electron transport - Functional dependence - GaAs - High temperature - Low temperatures - Photoresponses - Plasma excitation - Responsivity - Room temperature - Si-based - Temperature dependence - Tera Hertz - THz detection - THz detectors
Classification code:714.2 Semiconductor Devices and Integrated Circuits - 804.2 Inorganic

Compounds
DOI:10.1063/1.4733465
Database:Compendex