205

Accession number:20122915263168

Title:Terahertz and infrared spectroscopy of gated large-area graphene

Authors:Ren, Lei (1); Zhang, Qi (1); Yao, Jun (7); Sun, Zhengzong (2); Kaneko, Ryosuke (3); Yan, Zheng (2); Nanot, Sé bastien (1); Jin, Zhong (2); Kawayama, Iwao (3); Tonouchi, Masayoshi (3); Tour, James M. (2); Kono, Junichiro (1)

Author affiliation:(1) Department of Electrical and Computer Engineering, Rice University, Houston, TX 77005, United States; (2) Department of Chemistry, Rice University, Houston, TX 77005, United States; (3) Institute of Laser Engineering, Osaka University, Yamadaoka 2-6, Suita, Osaka 565-0871, Japan; (4) Department of Computer Science, Rice University, Houston, TX 77005, United States; (5) Department of Mechanical Engineering and Materials Science, Rice University, Houston, TX 77005, United States; (6) Department of Physics and Astronomy, Rice University, Houston, TX 77005, United States; (7) Applied Physics Program Through, Department of Bioengineering, Rice University, Houston, TX 77005, United States;

Corresponding author:Kono, J.(kono@rice.edu)

Source title:Nano Letters

Abbreviated source title:Nano Lett.

Volume:12

Issue:7

Issue date:July 11, 2012

Publication year:2012

Pages:3711-3715

Language:English

ISSN:15306984

E-ISSN:15306992

CODEN:NALEFD

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 have fabricated a centimeter-size single-layer graphene device with a gate electrode, which can modulate the transmission of terahertz and infrared waves. Using time-domain terahertz spectroscopy and Fourier-transform infrared spectroscopy in a wide frequency range (10-10 000 cmsup-1/sup), we measured the dynamic conductivity change induced by electrical gating and thermal annealing. Both methods were able to effectively tune the Fermi energy, E infF/inf, which in turn modified the Drude-like intraband absorption in the terahertz as well as the "2EinfF/inf onset" for interband absorption in the mid-infrared. These results not only provide fundamental insight into the electromagnetic response of Dirac fermions in graphene but also demonstrate the key functionalities of large-area graphene devices that are desired for components in terahertz and infrared optoelectronics. © 2012 American Chemical Society.

Number of references:42

Main heading: Terahertz waves

Controlled terms:Fermi level - Graphene - Infrared spectroscopy

Uncontrolled terms:Dirac fermions - Dynamic conductivity - Electrical gating - Electromagnetic response - Gate electrodes - Graphene devices - Interband absorption - Intraband absorptions -

Midinfrared - Single layer - Tera Hertz - Terahertz dynamics - Thermal-annealing - Time-domain terahertz spectroscopy - Wide frequency range

Classification code:701.1 Electricity: Basic Concepts and Phenomena - 711 Electromagnetic Waves - 741.1 Light/Optics - 761 Nanotechnology - 804 Chemical Products Generally DOI:10.1021/nl301496r

Database:Compendex

Compilation and indexing terms, Copyright 2012 Elsevier Inc.