Accepted Manuscript

Title: Cavity-enhanced optical Hall effect in epitaxial graphene detected at terahertz frequencies

Author: Nerijus Armakavicius Chamseddine Bouhafs Vallery Stanishev Philipp K*ü*hne Rositsa Yakimova Sean Knight Tino Hofmann Mathias Schubert Vanya Darakchieva

PII: S0169-4332(16)32118-3
DOI: http://dx.doi.org/doi:10.1016/j.apsusc.2016.10.023
Reference: APSUSC 34117

To appear in: *APSUSC*

Received date: 7-8-2016
Revised date: 4-10-2016
Accepted date: 4-10-2016

Please cite this article as: Nerijus Armakavicius, Chamseddine Bouhafs, Vallery Stanishev, Philipp K*ddotu*hne, Rositsa Yakimova, Sean Knight, Tino Hofmann, Mathias Schubert, Vanya Darakchieva, Cavity-enhanced optical Hall effect in epitaxial graphene detected at terahertz frequencies, *<![CDATA[Applied Surface Science]]>* (2016), http://dx.doi.org/10.1016/j.apsusc.2016.10.023

Cavity-enhanced optical Hall effect in epitaxial graphene detected at terahertz frequencies

Nerijus Armakavicius[a], Chamseddine Bouhafs[a], Vallery Stanishev[a], Philipp Kühne[a], Rositsa Yakimova[b], Sean Knight[c], Tino Hofmann[a,c,d], Mathias Schubert[a,c], Vanya Darakchieva[a,*]

[a] *Terahertz Materials Analysis Center, Department of Physics, Chemistry and Biology IFM, Linköping University, Sweden*

[b] *Semiconductor Materials, Department of Physics, Chemistry and Biology IFM, Linköping University, Sweden*

[c] *Department of Electrical and Computer Engineering, University of Nebraska-Lincoln, U.S.A.*

[d] *Department of Physics and Optical Science, University of North Carolina at Charlotte, U.S.A.*

Abstract

Cavity-enhanced optical Hall effect at terahertz (THz) frequencies is employed to determine the free charge carrier properties in epitaxial graphene (EG) with different number of layers grown by high-temperature sublimation on 4H-SiC(0001). We find that one monolayer (ML) EG possesses p-type conductivity with a free hole concentration in the low 10^{12} cm^{-2} range and a free hole mobility parameter as high as 1550 cm^2/Vs. We also find that 6 ML EG shows n-type doping behavior with a much lower free electron mobility parameter of 470 cm^2/Vs and an order of magnitude higher free electron density in the low 10^{13} cm^{-2} range. The observed differences are discussed. The cavity-enhanced THz optical Hall effect is demonstrated to be an excellent tool for contactless access to the type of free charge carriers and their properties in two-dimensional materials such as EG.

Keywords: THz optical Hall effect, epitaxial graphene, free charge carrier properties

1. Introduction

Graphene has attracted significant scientific interest due to its outstanding electronic properties, which arise from the linear electronic band structure resulting in massless Dirac-type fermion behavior [1, 2]. Epitaxial graphene (EG) grown on silicon carbide (SiC) by sublimation allows wafer-scale production of large-area homogeneous graphene on semi-insulating substrates that could be easily integrated in the current device fabrication technologies [3, 4, 5]. However, EG is significantly affected by the substrate properties and shows lower free charge carrier mobility compared to exfoliated graphene transferred on

*I am corresponding author

Email address: vanya.darakchieva@liu.se (Vanya Darakchieva)