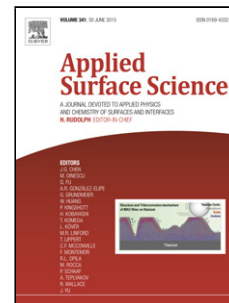


Accepted Manuscript

Title: Degradation Pattern of Black Phosphorus Multilayer Field–Effect Transistors in Ambient Conditions: Strategy for Contact Resistance Engineering in BP transistors

Authors: Byung Chul Lee, Chul Min Kim, Ho-Kyun Jang, Jae Woo Lee, Min-Kyu Joo, Gyu-Tae Kim



PII: S0169-4332(17)31153-4
DOI: <http://dx.doi.org/doi:10.1016/j.apsusc.2017.04.126>
Reference: APSUSC 35807

To appear in: *APSUSC*

Received date: 8-12-2016
Revised date: 14-4-2017
Accepted date: 17-4-2017

Please cite this article as: Byung Chul Lee, Chul Min Kim, Ho-Kyun Jang, Jae Woo Lee, Min-Kyu Joo, Gyu-Tae Kim, Degradation Pattern of Black Phosphorus Multilayer Field–Effect Transistors in Ambient Conditions: Strategy for Contact Resistance Engineering in BP transistors, *Applied Surface Science* <http://dx.doi.org/10.1016/j.apsusc.2017.04.126>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Degradation Pattern of Black Phosphorus Multilayer Field–Effect Transistors in Ambient Conditions: Strategy for Contact Resistance Engineering in BP transistors

Byung Chul Lee¹, Chul Min Kim¹, Ho–Kyun Jang¹, Jae Woo Lee², Min–Kyu Joo^{1,3*}, and Gyu–Tae Kim^{1*}

¹School of Electrical Engineering, Korea University, 136-701 Seoul, Republic of Korea

²ICT Convergence Technology for Health & Safety and the Department of Electronics and Information Engineering, Korea University, 2511 Sejong, Republic of Korea

³Center for Integrated Nanostructure Physics (CINAP), Institute for Basic Science (IBS), Suwon 16419, Republic of Korea

*Corresponding lovemkj@gmail.com and gtkim@korea.ac.kr

- Electrical degradation mechanism at channel and contact in black phosphorus field-effect transistor is separately suggested.
- Time dependent various electrical parameters such as carrier mobility, threshold voltage, and contact resistance are presented up to 2000 min.
- Oxygen doping effects on contact and surface oxidation effects on the surface of the channel in the black phosphorus transistors are highlighted.

Abstract

Black phosphorus (BP) has been proposed as a future optoelectronic material owing to its direct bandgap with excellent electrical performances. However, oxygen (O₂) and water (H₂O) molecules in an ambient condition can create undesired bubbles on the surface of the BP, resulting in hampering its excellent intrinsic properties. Here, we report the electrical degradation pattern of a mechanically exfoliated BP field–effect transistor (FET) in terms of the channel and contact, separately. Various electrical parameters such as the threshold voltage (V_{TH}), carrier mobility (μ), contact resistance (R_{CT}) and channel resistance (R_{CH}) are estimated by the Y function method (YFM) with respect to time (up to 2000 min). It is found that R_{CT} reduces and then, increases with time; whereas, the behavior of R_{CH} is vice versa in ambient conditions. We attribute these effects to oxygen doping at the contact and the surface oxidation effects on the surface of the BP, respectively.

Download English Version:

<https://daneshyari.com/en/article/5346936>

Download Persian Version:

<https://daneshyari.com/article/5346936>

[Daneshyari.com](https://daneshyari.com)