Influence of copper substrate pretreatment on CVD graphene electrical transport properties

Gvido Petersons[1] , Edgars Mamis[2] , Margarita Baitimirova[1] , Jana Andzane[1] , Martins Zubkins[3] , Juris Purans[3] , Asta Tamulevičienė[4] , Donats Erts[1]

[1] Institute of Chemical Physics, University of Latvia, Latvia
[2] Department of Chemistry, University of Latvia, Latvia
[3] Institute of Solid State Physics, University of Latvia, Latvia
[4] Kaunas University of Technology, Lithuania
e-mail: gvido.petersons@lu.lv

Graphene is a two-dimensional crystalline allotrope of carbon. Due to its unique properties, such as high mechanical strength and flexibility, great electrical and thermal conductivity and optical transparency, graphene is perfect to be used in applications such as flexible electronics, gas sensors, touch screens, light panels and solar cells, where it can replace the rather fragile and expensive Indium-Tin-Oxide (ITO) [1]. The most promising method of large size and good quality graphene synthesis is chemical vapor deposition (CVD) method on copper surface with followed by its transfer by polymer-assisted technique [2]. During the synthesis graphene domains are forming according crystallographic orientation of the underlying copper grains. Therefore quality of obtained graphene depends on crystalline and surface properties of copper substrate [3].

In this work, resistivity of CVD graphene synthesized on differently pre-treated copper substrates was compared. Copper substrates, pre-annealed and non-pre-annealed, were chemically and electrochemically polished by using different acids. Graphene was synthesized on the pre-treated substrates by CVD method. Number of graphene layers was checked by Raman spectroscopy. Areas of obtained copper grains were calculated from optical and scanning electron microscope images by linear analysis method and Jeffries method. The roughness of copper substrate was measured by atomic force microscope. Electrical properties of fabricated graphene were analyzed by voltammetry measurements in 4-point configurations. Hall effect and charge carrier mobility was measured by Van der Pauw method.

References

1. D. A. C. Brownson, C. E. Banks, Springer: London, Heidelberg, New York, Dordrecht, p. 201 (2014)
2. C. Mattevi, H. Kim, M. Chhowalla, J. Mater. Chem. 21, 3324 (2011)
3. D. Lee, G.D. Kwon, J.H. Kim, E. Moyen, Y.H. Lee, S. Baik, D. Pribat, Nanoscale 6, 12943 (2014)

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