

Epitaxial graphene on SiC and its applications

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Abstract

Epitaxial graphene on SiC is a new material concept combining the carbon based two dimensional (2D) semimetal graphene with the wide band gap semiconductor silicon carbide. Integration of graphene with SiC promotes the birth of a class of hybrid materials which are highly promising for development of novel operations, since they associate the best properties of two counterparts in the frame of one platform. As a specific heterostructure, graphene on SiC performance is dependent on the synthesis method and the growth modes.

In this talk we are going to focus on the following important issues: (i) Epitaxial graphene fabrication by thermal decomposition of SiC using a patent protected process in which the dual role of the SiC substrate will be discussed since it acts also as a precursor of graphene synthesis. Buffer layer formation and its effect on graphene properties will be considered. (ii) Half integer quantum Hall effect in epitaxial graphene allow high performance quantum Hall devices and their application in metrology as resistance standard will be addressed. (iii) Interaction of epitaxial graphene with metals will be elucidated and our understanding of potential sensor applications will be presented. interfacing this combined system with different metals may allow tunability of electronic and optical properties. Here, we explore the behaviour of selected metals (Li, Ag and Pb) on epitaxial graphene obtained by thermal decomposition of Si-face 4H SiC (0001). We show that the observed effects, related to Ag and Pb, are excellent prerequisites of optical and electrochemical sensing, while lithiation is promising for charge storage. The interaction of metals with graphene is revealed by in depth analysis of Raman spectra, C-AFM and TEM supported by DFT modelling. Significant enhancement of G mode intensity after 5 nm Ag deposition was found to be related to plasmonic phenomena. Due to its extraordinary chemical and thermal stability, large active surface area and wide potential window, graphene-covered Si-terminated 4H-SiC has an enormous potential to be used effectively as an electrode. Electrochemical performance of the graphene electrode with Pb and Li was studied in detail by using anodic stripping and cyclic voltammetry, and chronoamperometry. The talk will end with our vision on future projects and research advancement based on epitaxial graphene on SiC.

Biography

Rositsa Yakimova has completed her PhD from St. Petersburg Electrotechnical University, Russia and postdoctoral studies from National Research Council, Canada and Linkoping University, Sweden. She is Professor in material science and research group leader of SiC and graphene growth and applications. She has pioneered several growth methods and has established a startup company on epitaxial graphene in Sweden. She has published more than 500 papers in high impact factor journals and has more than 6000 citations. She has been serving as an editorial board member of several reputed journals and as a consultant for renown companies.