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Invited speaker's information form of IUMRS-ICA2017

Presentation on Symposium of "smart materials (D7)"

Presentationtitle:Fundamental coupling between ferroelectric polarization and graphene 2D nanomaterials

Speaker's name and affiliation: Jianhua Hao,The Hong Kong Polytechnic University

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Brief biography of Speaker:

Jianhua Hao is a Full Professor and Associate Head in the Department of Applied Physics at the Hong Kong Polytechnic University (PolyU). Prof. Hao received his Bachelor, Master and Doctoral degrees at Huazhong University of Science and Technology (HUST), China. After working at HUST, Penn State University, USA, University of Guelph, Canada and the University of Hong Kong, Prof. Hao joined the faculty in PolyU in 2006. Prof. Hao has published over 210 SCI papers and 2 book chapters. He has been listed as one of Most Cited Scientists in Materials Science by ESI. He is the first inventor of 5 US patents. Prof. Hao has been PI in 14 government external competitive grants in PolyU. He serves as Editorial Board Member/Senior Editor for several international journals, such as Scientific Reports（NPG）and Advanced Optical Materials (Wiley). He was General Chair/Session Chair/Organizing Committee Member in many international conferences and also invited to give a number of Plenary/Keynote/Invited Lectures in variousconferences. Prof. Hao's current research interests include (1) Luminescence and phosphors for photonic, energy and biomedical applications; (2) Functional thin-films, two-dimensional layered materials and heterostructures (Hao research group website: http://ap.polyu.edu.hk/apjhhao/).

Abstract: The shrinking of the geometrical dimensions of current semiconductor devices has required the adoption of new materials and new device geometries. Graphene-based field effect transistor (GFET) has been among the breakthrough results of nanoscale electronic devices. Many types of graphene-based devices have been presented. Among the functional dielectrics, ferroelectrics not only possess high dielectric constant, but also exhibit non-volatile memory behaviours due to their unique feature of spontaneous polarization. In our study, we found that the electronic and optical properties of graphene and two-dimensioal (2D) materials could be tuned by the ferroelectric polarization and piezoelectricity. We have characterized the microstructure, ferroelectric and electrical properties of various ferroelectric/2Dheterostructures.However, a fundamental problem of GFET is that the device remains conducting even when switched off, ascribed to the absence of an energy gap in graphene. Hence, an obstacle to application for all types of developed planar GFETs is their quite low current on/offratio. A new conceptual GFET, namely vertical graphene heterostructure FET (VGHFET) is attractive. We have developed a novel FET with the complementary heterostructure possessing the features of both ferroelectricity andconventional GFET.Taking advantage of the enhanced performance, the gate modulation ability of GFETs will become stronger, and the power consumption will become lower.Our work presents the possibility of creating variousmultifunctional nanoscale devices by engineering a ferroelectrictunnel layer with 2D layer building blocks.The research was supported by the grant from Research Grants Council of Hong Kong (GRF No. PolyU 153031/15P).

References:

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