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材料物理和化学

石墨烯在半导体光电器件中的应用

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摘要： 基于石墨烯透明、软性、能带结构连续可调、电子迁移率高等一系列优点,着眼于石墨烯与其他半导体光电功能材料的复合,对石墨烯在有机和无机发光二极管、太阳能电池、纳米发电机等方面的应用和研究进展进行了介绍。

关键词： 石墨烯 发光二极管 太阳能电池 纳米发电机

Application of Graphene in Semiconductor Optoelectronic Devices

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Abstract: Graphene, as a multifunctional two-dimensional nanomaterial, has inspired the considerable interests on its application in novel nanodevices. In this paper, the optoelectronic function of the complexes of typical semiconductors and graphene was reviewed based on the graphene's advantages of transmission, flexibility, turnable energy bandgap, and high electron mobility. It presented the representative application of graphene in inorganic and organic light-emitting diodes, solar cells, and nanogenerators. It is expected that graphene would play an important role for further nanometer sized electronic and photonic devices in the post-Mole era.

Keywords: graphene light-emitting diode solar cell nanogenerator

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参考文献：

[1] Zhu Yanwu, Murali Shanthi, Cai Weiwei, *et al.* Graphene and graphene oxide: synthesis, phroperties, and applications [J]. *Adv. Mater.,* 2010, 22(35):3906-3924. [2] Novoselov K S, Geim A K, Morozov S V, *et al.* Electric field effect in atomically thin carbon films[J].*Science,* 2004, 306(5696):666-669. [3] Allen Mattew J, Tung Vincent C, Kaner Richard B. Honeycomb carbon a review of graphene[J].*Chem. Rev.,* 2010, 110(1):132-145. [4] Bonaccorso F, Sun Z, Hasan T, *et al.* Graphene photonics and optoelectronics[J]. *Nature, Photo,* 2010, 4:611. [5] 袁文明. 石墨烯基电子学研究进展[J]. 微纳电子技术, 2010,47(10):589-594. [6] 胡耀娟,金娟,张卉,等.石墨烯的制备、功能化及在化学中的应用[J]. 物理化学学报, 2010,2(8):2073-2086. [7] Class for Physics of the Royal Swedish Academy of Sciences.Scientific background on the Nobel Prize in physics 2010:GRAPHENE .http://nobelprize.org/nobel_prizes/physics/laureates/2010/sic.html. [8] Liu Chenguang, Yu Zhenning, Neff David, *et al.* Graphene-based supercapacitor with an ultrahight energy density [J].*Nano Lett.,* 2010, 10(12):4863-4868. [9] Liao Lei, Lin Yungchen, Bao Mingqiang, *et al.*High-speed graphene transistors with a self-aligned nanowire gate[J].*Nature,* 2010, 467(7313):305-308. [10] Mueller Thomas, Xia Fengnian, Avouri Phaedon. Graphene photodetectors for high-speed optical communications[J].*Nature Photo,* 2010, 4(5):297-301. [11] Bao Qiaoliang, Zhang Han, Wang Yu, *et al.* Atomic-layer graphene as a saturable absorber for ultrafast pulsed lasers[J].*Adv. Func. Mater,* 2009, 19(19):3077-3083. [12] Chung Kunook, Lee Chulho, Yi Gyuchul. Transferable GaN layers grown on ZnO-coated graphene layers for optoelectronic devices[J]. *Science,* 2010, 330(6004):655-657. [13] Sun T, Wang Z L, Shi Z J, *et al.* Multilayered graphene used as anode of organic light emitting devices[J].*Appl. Phys. Lett.,* 2010, 96(13):133301(1-3). [14] Wu Junbo, Agrawal Mukul, Becerril Hector A. Organic light-emitting diodes on solution-processed graphene transparent electrodes [J].*ACS Nano,* 2010, 4(1):43-48. [15] Matyba Piotr, Yamaguchi Hisato, Eda Gokl, *et al.* Graphene and mobile ions: the key to all-plastic, solution-processed light-emitting devices[J]. *ACS Nano,* 2010, 4(2):637-642. [16] Matyba Piotr, Yamaguchi Hisato, Chhowalla Manish, *et al.* Flexible and metal-free light-emitting electrochemical cells based on graphene and PEDOT-PSS as the electrode materials [J].*ACS Nano,* 2011, 5(1):574-580. [17] Li Xinming, Zhu Hongwei, Wang Kunlin, *et al.* Graphene-on-silicon Schottky junction solar cells[J].*Adv. Mater,* 2010, 22(25):2743-2748. [18] Jo Gunho, Na Seokin, Oh Seunghwan, *et al.* Tuning of a graphene-electrode work function to enhance the efficiency of organic bulk heterojunction photovoltaic cells with an inverted structure[J].*Appl. Phys. Lett.,* 2010, 97(21):213301-03. [19] Ye Yu, Dai Yu, Dai Lun, *et al.* High-performance single CdS nanowire (nanobelt) Schottky junction solar cells with Au/graphene Schottky electrodes.[J].*ACS Appl. Mater. Interfaces,* 2010, 2(12):3406-3410. [20] Wang Yu, Tong Shiwun, Xu Xiangfan, *et al.* Interface engineering of layer-by-layer stacked graphene anodes for high-performance organic solar cells [J],*Adv. Mater,* 2011, 23(13):1514-1518. [21] Akhavan Omid.Graphene nanomesh by ZnO nanorod photocatalysts[J]. *ACS Nano.,* 2010, 4(7):4174-4180. [22] Roy-Mayhew Joseph D, Bozym David J, Punckt Christian, *et al.* Functionalized graphene as a catalytic counter electrode in dye-sensitized solar cells[J]. *ACS Nano,* 2010, 4(10):6203-6211. [23] Wang X D, Song J H, Liu J, *et al.* Direct-current nanogenerator driven by ultrasonic waves[J].*Science,* 2007, 316(5821):102-105. [24] Qin Y, Wang X D, Wang Z L. Microfibre-nanowire hybrid structure for energy scavenging[J]. *Nature,* 2008, 415(7180):809-813. [25] Kim Keun Soo,

Zhao Yue, Jang Houk, *et al.* Large-scale pattern growth of graphene films for stretchable transpa-rent electrodes [J].*Nature*, 2009, 457(7230):706-710. [26] Shin Hyeonjin , Choi Wonmook, Choi Dukhyun, *et al.* Control of electronic structure of graphene by various dopants and their effects on a nanogenerator [J]. *J. Am. Chem. Soc.,* 2010, 132 (44) :15603-15609. [27] Choi Dukhyun, Choi Minyeol, Choi Wonmook, *et al.* Fully rollable transparent nanogenerators based on graphene electrodes[J]. *Adv. Mater.,* 2010, 22(19):2187-2192.

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7．蒋谦, 张方辉.2, 5, 8, 11-Tetra-Tertbutylperylene作为辅助掺杂剂的红色有机电致发光二极管[J]. 液晶与显示, 2010,25(5): 666-671

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