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中英科技桥

Science Bridges China Research Profile

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SUMMARY OF MY RELEVANT RESEARCH AREAS:

Graphene technologies; Nano-biological interaction; Biosensors; Nanotoxicity

石墨烯技术；纳米-生物之间的相互作用；生物传感器；纳米材料的安全性研究

Primary Research interests:

We are centered on using chemical and physical engineering approaches towards synthesis and fabrication of 2-dimensional layered materials with novel electronic, photonic, and chemical properties, *ie.*, π-electron materials and optoelectronic devices.

1. Controllable synthesis of graphene and its applications for biological sensors and clean energy. A wide range of applications has been demonstrated for graphene, including biomedicine such as rapid DNA sequencing, and energy generation and storage. Chemical and biological sensors are important for environmental monitoring, disease diagnostics, food processing, and homeland security. Particularly, low-cost, high-throughput, scalability, and high-speed DNA sequencing would revolutionize the diagnosis, prevention and treatment of most, if not all, human diseases. The challenges now preventing the use of graphene in practical applications lie in layer- and crystalline structure-controllable synthesis of graphene materials with scalable size.

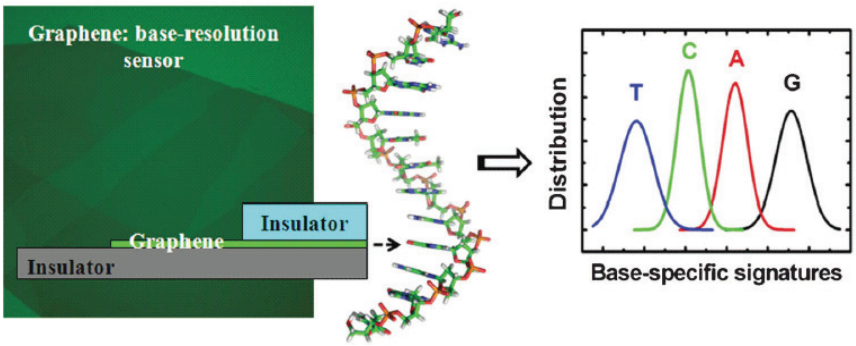


FIG. Graphene for electronic DNA sequencing

2. Nanotoxicity. We focus on the study of potential impact of nanomaterials on environment, health and society (NanoEHS) towards the safe design and synthesis of nanomaterials.

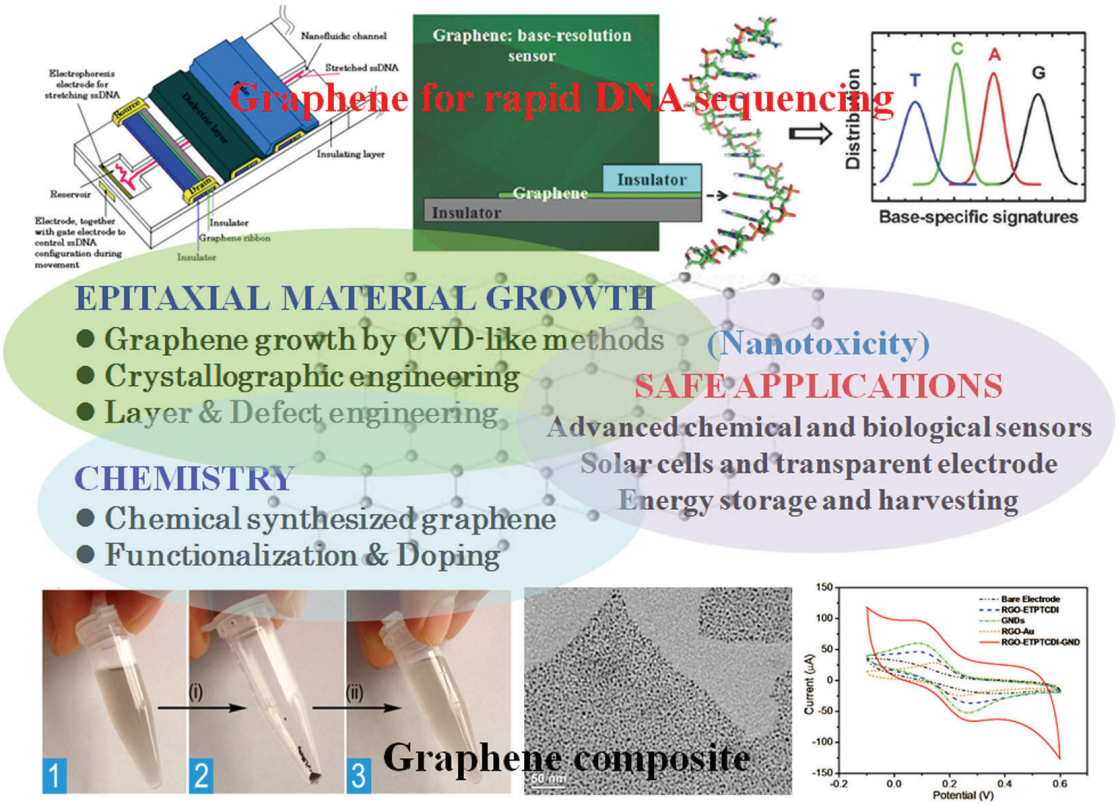
Topics in which you would like to develop collaborative research:

- **Graphene technologies for biosensors, *e.g.*, rapid electronic DNA sequencing, glucose, DNA and protein sensing.**
- **Nanotoxicity, *e.g.*, identification of the key physicochemical characteristics that govern the interaction between nanomaterials and biological system.**

Relevant existing collaborations (academic/clinical/commercial) inside or outside China.

1. Nara Institute of Science and Technology, Japan
2. National Institute for Materials Science (NIMS), Japan

Relevant graphics, figures, pictures:



Development of safe graphene-based materials for healthcare as well as clean energy, including synthesis of graphene materials with fine control of the number of graphene layers and crystal structures, and chemical-derived graphene with special functional groups. High-quality graphene-based materials would allow us to develop chemical and biological sensors such as rapid DNA sequencers that could help to enable the realization of personalized medicine.

Publications and other outputs relevant to your interest in this programme

1. Hongzheng Chen, et al., "Graphene uniformly decorated by gold nanodots: in-situ synthesis, enhanced dispersibility and its applications", J. Mater. Chem. 21, 8096-8103 (2011).
2. Mingsheng Xu, et al., "Production of extended single-layer graphene", ACS Nano 5, 1522-1528 (2011).
3. Mingsheng Xu, et al., "Contribution of physicochemical characteristics of nano-oxides to cytotoxicity", Biomaterials 31, 8022-31 (2010).
4. Mingsheng Xu, et al., "Perspective and challenges of emerging single-molecule DNA sequencing technologies", Small 5, 2638-2649 (2009).
5. Mingsheng Xu, et al., "Nanopore electrical sensor", Pub. No. WO2011/047582 (pending patent)