



THE CHINESE UNIVERSITY OF HONG KONG  
Department of Electronic Engineering  
Material Science and Technology Research Center  
Hong Kong Materials Research Society



JOINT SEMINAR

Prof. Dr. Jinbo Pang  
Institute for Advanced Interdisciplinary Research (iAIR),  
University of Jinan

Date: 19 September, 2023 (Tuesday)

Time: 2:30 p.m.

Venue: Rm 222, Ho Sin Hang Engineering Building, The Chinese University of Hong Kong

**Seminar 1:**

Thermodynamic and Kinetic Regulation of Chemical Vapor Deposition for Two-dimensional Materials Growth

Abstract:

In the post Moore era, the size reduction seems to stop; besides, the rigid Si based technology faces difficulties in lightweight portable electronics and stretchable wearable electronics. The emerging graphene related 2D materials may serve as electronic functional components to fabricate quantum information devices and conventional transistors, photodetectors and digital logic circuits. Indeed, the 2D materials and their van der Waals heterostructure may provide solution for continuing the goal of size reduction. Therefore, the controlled growth of 2D materials become of vital importance. We have carried out systematic research on the controllable growth of two-dimensional materials, and have made a series of progress. (1) The direct growth of graphene over dielectric substrates remains attractive for device fabrication without transfer step. We apply thermodynamic and kinetic control to realize strictly monolayer graphene growth over dielectric substrate by chemical vapor deposition. (2) The strategy of pre-seeding layer is proposed to realize the thermodynamic control of nucleation. Hereby, the strict monolayer tungsten diselenide of sub-centimeter size is synthesized, which solves the problem of discontinuous film formation. (3) By regulating the symmetry matching in the interaction between substrate and two-dimensional materials, a wafer-level platinum sulfide thin film is synthesized, which improves the large-area homogeneity. The first-principles calculations predict the phase diagram of Pt-S versus the temperature and partial pressure of sulfur. In sum, we have published 35 papers as (joint-) first author or corresponding author in journals such as Chem Soc Rev, Adv Energy Mater, ACS Nano, InfoMat (3), Small, TrAC, and Nano-Micro Lett (2). Our research may provide important guideline for research community and pave the way toward wafer-scale growth of two-dimensional materials and their applications in quantum technologies.

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## Seminar 2:

### Smart Sensing based on The Innovation Materials of MXenes

#### Abstract:

The Internet of Things era has promoted enormous research on sensors, communications, data fusion, and actuators. Among them, sensors are a prerequisite for acquiring the environmental information for delivering to an artificial data center to make decisions. The MXene-based sensors have aroused tremendous interest because of their extraordinary performances. In this review, the electrical, electronic, and optical properties of MXenes are first introduced. Next, the MXene-based sensors are discussed according to the sensing mechanisms such as electronic, electrochemical, and optical methods. Initially, biosensors are introduced based on chemiresistors and field-effect transistors. Besides, the wearable pressure sensor is demonstrated with piezoresistive devices. Third, the optical approaches refer to surface plasmonic resonance and fluorescence resonance energy transfer. Forth, the electrochemical methods include amperometry and electrochemiluminescence as examples. Subsequently, the prospects are delivered of multimodal data fusion toward complicated human-like senses. Eventually, future opportunities for MXene research are conveyed in the new material discovery, structure design, and proof-of-concept devices.

#### References

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#### Biography

Dr Jinbo Pang completed his doctorate in materials science with thermal deposition approaches for graphene growth at Technische Universität Dresden (Germany) in 2017. After his study of two-dimensional materials transition metal dichalcogenides in IFW Dresden as a post doctorate, he joined Institute for Advanced Interdisciplinary Research (iAIR), University of Jinan, China as an assistant professor (in 2018) and associate professor (in 2022), where he directed his research to wafer-scale controlled growth of two-dimensional materials and their electronic and optoelectronic device applications. This led to the award of Natural Science Fund for Excellent Young Scholars of Shandong Province. He was awarded the First Prize of Invention Innovation and Entrepreneurship Award by China Association of Inventions (CAI) 2023 in 2<sup>nd</sup> place (6 in total). Dr. Pang served as a member of Youth Editorial Board of several high-impact journals such as *InfoMat* (Wiley), *eScience* (Elsevier), *Nano-Micro Lett* (Springer), *Exploration* (Wiley), *Nano Research* (Springer), *Instrumentation* (China Instrument & Control Society), *Tungsten* (Springer), *Chinese Journal of Structural Chemistry* (Elsevier), *Brain-X* (Wiley), and *Frontiers of Chemical Science and Engineering* (Springer). He has served in organizing and academic committee of several conferences. He has published over 70 journal papers with a total citation of 5145, an h index of 36 (updated by Sep 1, 2023).

ALL ARE WELCOME