

Interfacial Synthesis of Two-Dimensional Polymers

Zhikun Zheng¹

Hafeesudeen Sahabudeen², Haoyuan Qi³,
Kejun Liu², Tao Zhang², Ute Kaiser³, Xinliang
Feng²

¹School of Chemistry, Sun Yat-sen University, No.
135, Xingang Xi Road, Guangzhou, 510275, P. R.
China

²Department of Chemistry and Food Chemistry
& Center for Advancing Electronics Dresden
(cfaed), Technische Universitaet Dresden,
Germany

³Central Facility for Electron Microscopy, Group
of Electron Microscopy of Materials Science,
University of Ulm, 89081 Ulm, Germany

zhengzhikun@mail.sysu.edu.cn

At present, one of the key challenges faced by the scientific community is to go beyond graphene, a prototypical two-dimensional polymer (2DP, a laterally infinite, one atom- or monomer-unit thin, free-standing network with long-range order along two orthogonal directions), to synthesize its analogues with structural control at the atomic- or molecular- level under mild conditions. Here we present the rational synthesis of monolayer and multilayer 2DPs with rigid and symmetric monomers through reversible coordination and dynamic covalent reactions at an air-water interface and liquid-liquid interface. [1-5] Such 2DPs have single crystalline domains with a lateral size in the range of hundreds nm² to μm². They have a thickness of □ 0.5 – 10 nm and a lateral size in the range of cm² to 4-inch wafer, and can be freely suspended over 20 μm × 20 μm sized holes. They are rigid and flexible, and can be conformed and bonded robustly to nearly any surface, facilitating their integration into devices. Proof-of-concept applications of such 2DPs suggest they are promising materials for energy-related technologies and field-effect transistors.

References

- [1] H. Sahabudeen, H. Qi, B. A. Glatz, D. Tranca, R. Dong, Y. Hou, T. Zhang, C. Kuttner, T. Lehnert, G. Seifert, U. Kaiser,

A. Fery, Z. Zheng,* and X. Feng*, *Nat. Commun.*, 7 (2016) 13461

- [2] Z. Zheng, R. Grönker, X. Feng*, *Adv. Mater.*, 28 (2016) 6529-6545.
- [3] R. Dong, M. Pfeiffermann, H. Liang, Z. Zheng, X. Zhu, J. Zhang, X. Feng*, *Angew. Chem. Int. Ed.*, 54 (2015) 12058-12063.
- [4] Z. Zheng*, L. Opilik, F. Schiffmann, W. Liu, G. Bergami, P. Ceroni, L. Lee, A. Schütz, J., Sakamoto, R. Zenobi, J. VandeVondele, A. D. Schlüter*, *J. Am. Chem. Soc.*, 136 (2014) 6103-6110.
- [5] Payam Payamyar, Khaled Kaja, Carlos S. Ruiz-Vargas, Andreas Stemmer, Daniel J. Murray, Carey Johnson, Benjamin T. King, Alois Renn, Andri Schütz, Lay-Theng Lee, Zhikun Zheng, Junji Sakamoto, A. Dieter Schlüter*, *Adv. Mater.*, 26 (2014) 2052-2058

Figures

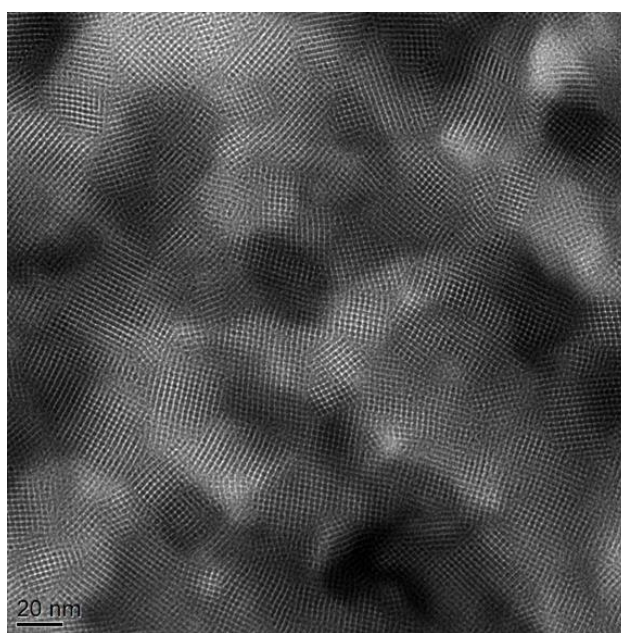


Figure 1: High-resolution TEM image of 2D polyimine synthesized at an air-water interface.