Functionalizing monolayer graphene as a proton-selective membrane for direct methanol fuel cells

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CURRICULUM VITAE

Weizhe Zhang was born in Chuzhou, Anhui, China in February 1992. He obtained his bachelor degree from Department of Material Science and Engineering of Beihang University in Beijing, 2014. His research topic was 'The performance evaluation of automatically fabricated polymer-based carbon fiber composites'. In 2014, he started the research on 'Conductive polymer modified carbon fiber cloth and reduced graphene oxide film as anode in microbial fuel cells', under supervision of prof. Hong Liu in Department of Biology and Medicine Engineering of Beihang University. He obtained a master degree in Biological Technology in 2017. In the same year, he moved to Leiden University to his PhD study on '2D membranes and fuel cells' in the group of Supramolecular & Biomaterials Chemistry (SBC), Leiden Institute of Chemistry (LIC), under the supervision of dr. Grégory F. Schneider and prof. dr. Alexander Kros. For the electrocatalysis studies, he worked with dr. Dennis Hetterscheid, Bas van Dijk, and dr. Mingchuan Luo from LIC. For studies using monocrystalline graphene, he collaborated with prof. dr. Zhongfan Liu, dr. Luzhao Sun and colleagues from the Beijing Graphene Institute (China). The theoretical studies were performed together with dr. Francesco Buda, Dario Calvani from LIC, prof. dr. Thomas Heine from Technical University Dresden (Germany) and dr. Agnieszka Kuc from the Helmholtz-Zentrum Dresden-Rossendorf (Germany). Electron microscopy studies were performed together with prof. dr. Xinliang Feng and prof. dr. Ute Kaiser, dr. Haoyuan Qi and Christopher Leist from Ulm University (Germany). During his PhD study, he supervised two bachelor students and taught one research course in the Chemical Energy Transition lecture series as part of the Leiden-Delft Minor on Sustainable Chemistry and Biotechnology. He followed the 'Scientific Conduct' course provided by the Graduate School of Leiden University and presented his research at several (inter)national conferences.

Invited talk:

Chemistry as Innovating Science (**CHAINS**), **2022,** Veldhoven, The Netherlands, Proton conductive graphene membrane & application in direct methanol fuel cells.

Posters:

Chemistry as Innovating Science (**CHAINS**), **2018,** Veldhoven, The Netherlands.
Reduction of oxygen with nitrogenated graphene monolayer.
Zhang W.; van Dijk, B.; Jiang, L.; Hetterscheid, D.; Schneider, G. F..

Chem2Dmat, **2021**, online.
A proton conductive graphene composed membrane for direct methanol fuel cell.
Zhang, W.; Liu, X.; Schneider, G. F..

Graphene Week, **2022**, Munich, Germany.
Proton transport through sulphonated graphene in a direct methanol fuel cell.

Zhang, W.; Makurat, M.; Liu, X.; Kang, X.; Liu, X.; Kock, J.F.T.; Leist, C.; Maheu, C.; Sezen, H.; Qi, H.; Feng, X.; Hofmann, J. P.; Kaiser, U.; Sun L.; Liu, Z.; Schneider, G. F..

Graphene2023, **2023**, Manchester, United Kingdom (poster prize).
Polyelectrolyte multilayers on graphene as proton exchange membrane.
Jiang, G.; **Zhang, W.**; Makurat, M., Fu, W., Schneider, G. F.

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Selective proton channel in monolayer graphene tuned by sulfophenylation of CVD graphene.
Kang, X.; **Zhang, W**.; Makurat, M.; Li, Y.; Kock, J.F.T.; Leist, C.; Maheu, C.; Sezen, H.; Jiao, A.; Fu, W.; Feng, X.; Hofmann, J. P.; Kaiser, U.; Sun L.; Liu, Z.; Schneider, G. F.

LIST OF PUBLICATIONS

Published:

1. **Zhang, W.**; Makurat, M.; Liu, X.; Kang, X.; Liu, X.; Li, Y.; Kock, T. J.F.; Leist, C.; Maheu, C.; Sezen, H.; Jiang, L.; Calvani, D.; Jiao, A.; Eren, I.; Buda, F.; Kuc, A.; Heine, T.; Qi, H.; Feng, X.; Hofmann, J. P.; Kaiser, U.; Sun L.; Liu, Z.; Schneider, G. F., Giant proton transmembrane transport through sulfophenylated graphene in a direct methanol fuel cell. https://doi.org/10.48550/arXiv.2308.16112 (pre-print).

2. Huang, Y.; Yin, S.; Huang, Y.; Zhang, X.; **Zhang, W.**; Jiang, G.; Zhu, H.; Wan, C.; Fu, W., Biochemical sensors: Graphene oxide/hexylamine superlattice field-effect biochemical sensors. *Advanced Functional Materials* **2021**, 31, 2170167.

3. **Zhang, W.**; Xie, B.; Yang, L.; Liang, D.; Zhu, Y.; Liu, H., Brush-like polyaniline nanoarray modified anode for improvement of power output in microbial fuel cell. *Bioresource Technology* **2017**, 233, 291-295.

4. Li, B.; Dong, C.; Chu, Z.; **Zhang, W.**; Wang, M.; Liu, H.; Xie, B., Synthesis, characterization and application of ion exchange resin as a slow-release fertilizer for wheat cultivation in space. *Acta Astronautica* **2016**, 127, 579-586.

5. **Zhang, W.**; Xie, B.; Liu, H., Utilization and perspective of carbon nanotube/polyaniline composites as anode for improvement of MFC. In Materials Engineering and Environmental Science, *World Scientific* **2016**, 1, 236-246.

In preparation:

1. **Zhang W.**; van Dijk, B.; Wu, L.; Maheu, C.; Tudor, V.; Hofmann, J. P.; Jiang, L.; Hetterscheid, D.; Schneider, G. F., The role of vacancy defects and nitrogen dopants for the reduction of oxygen on graphene. **Submitted.**

2. **Zhang W.**; Schneider, G. F., Graphene membrane electrode assembly for direct methanol fuel cells. **Submitted.**

3. **Zhang W.**; Liu, X.; Sun L.; Liu, Z.; Schneider, G. F., Shading a monolayer of graphene with multilayer patches to rationalize proton transport in direct methanol fuel cells. **In preparation**.

4. **Zhang W.**; Schneider, G. F., Ion-sieving membrane devices: Advancements in sub-nanometer precision, atomically thin, and large-area platforms utilizing low-dimensional materials. **In preparation.**