



Universiteit
Leiden
The Netherlands

Chemical functionalization of the graphene surface for electrical and electrochemical sensing applications

Jiang, L.

Citation

Jiang, L. (2020, February 27). *Chemical functionalization of the graphene surface for electrical and electrochemical sensing applications*. Retrieved from <https://hdl.handle.net/1887/85674>

Version: Publisher's Version

License: [Licence agreement concerning inclusion of doctoral thesis in the Institutional Repository of the University of Leiden](#)

Downloaded from: <https://hdl.handle.net/1887/85674>

Note: To cite this publication please use the final published version (if applicable).

Cover Page



Universiteit Leiden



The handle <http://hdl.handle.net/1887/85674> holds various files of this Leiden University dissertation.

Author: Jiang, L.

Title: Chemical functionalization of the graphene surface for electrical and electrochemical sensing applications

Issue Date: 2020-02-27

Curriculum Vitae

Lin Jiang was born in Rizhao, Shandong province, China, on September 16th in 1988. In 2007, she graduated from Rizhao Experimental High School and enrolled as a bachelor student in marine science at Qingdao University of Science and Technology. In 2011, Lin graduated with her thesis entitled “Recycling and utilization of purified terephthalic acid” under the supervision of Prof. Dr. Kongcheng Hu. Lin continued her master study at Shanghai University under the supervision of Prof. Dr. Yaping Ding. Her research program focused on the fabrication of electrochemical biosensors based on novel graphene nanocomposites. As a master student, Lin received the “National Scholarship” and “Elite Student” Award from Shanghai University.

In 2014, Lin was granted a Chinese Scholarship Council scholarship (L.J., 201406890016) to start her PhD studies in the research group of Dr. Grégory F. Schneider in the department of Supramolecular & Biomaterials Chemistry (SBC) at Leiden University. During her PhD study, Lin collaborated with Dr. Yuvraj Birdja and Prof. Dr. Marc T. M. Koper on the electrochemical activity of hydrogenated graphene. With Bas van Dijk, M.Sc. and Dr. Dennis G. H. Hetterscheid, Lin further expanded her knowledge on the electrocatalysis of oxygen reduction reaction (ORR) using nitrogenated graphene. She also collaborated with Dr. Jiao and Prof. Dr. Harold Linnartz, Laboratory Astrophysics of Leiden University, as well as with Dr. Longfei Wu and Dr. Jan P. Hofmann, Eindhoven University of Technology, on the surface chemistry of graphene. In 2019, Lin was selected as a young editorial board of Chinese Chemical Letter (CCL, IF = 3.839). Lin was the co-founder of the Leiden Science China community, a student association in Leiden University aiming at strengthening connections between international students.

The results reported in this thesis were presented at several national and international conferences as listed below:

- NWA startimpuls workshop, Den Haag, the Netherlands, **invited talk** (13 September 2019).
- KNCV Electrochemistry Symposium, Groningen, the Netherlands, **invited talk** (23 November 2018).
- Graphene Week 2017, Athens, Greece, **contributing talk** (25-29 September 2017).
- Young Scholars Forum of Sun Yat-Sen University 2017, Guangzhou, P.R. China, **invited talk** (16-18 June 2017).

- 1st European Conference on Chemistry of Two-Dimensional Materials (Chem2DMat), Strasbourg, France, **contributing talk** (22-26 August 2017).
- CHAINS Conference 2017, Veldhoven, the Netherlands, **Best Poster Award** (5-7 December 2017).
- CHAINS Conference 2016, Veldhoven, the Netherlands, **poster** (6-8 December 2016).
- CHAINS Conference 2015, Veldhoven, the Netherlands, **poster** (30 November-2 December 2015).

List of Publications

1. Quantum and electrochemical interplays in hydrogenated graphene.

Lin Jiang, Wangyang Fu, Yuvraj Y. Birdja, Marc T. M. Koper, Grégory F. Schneider, *Nature Communications*, 2018, 9(1), 793.

2. Contact angle measurement of free-standing square-millimeter single-layer graphene.

Anna V. Prydatko, Liubov A. Belyaeva, **Lin Jiang**, Lia M. C. Lima, Grégory F. Schneider, *Nature Communications*, 2018, 9 (1), 4185.

3. Liquids relax and unify strain in graphene.

Liubov A. Belyaeva, **Lin Jiang**, Jelger H. Risselada, Jeroen Methorst, Grégory F. Schneider, *Nature Communications*, in press (2020).

4. Effects of substrate and polymer encapsulation on CO₂ electroreduction by immobilized indium (III) protoporphyrin.

Yuvraj Y. Birdja, Rafael E. Vos, Tim A. Wezendonk, **Lin Jiang**, Freek Kapteijn, Marc T. M. Koper, *ACS Catalysis*, 2018, 8(5), 4420-4428.

5. Redox interconversion between Co^{III} thiolate and Co^{II} disulfide compounds.

Feng Jiang, Maxime A. Siegler, Xiaobo Sun, **Lin Jiang**, Celia Fonseca Guerra, Elisabeth Bouwman, *Inorganic Chemistry*, 2018, 57(15), 8796-8805.

6. Sensing at the surface of graphene field-effect transistors.

Wangyang Fu, **Lin Jiang**, Erik P. van Geest, Lia M. C. Lima, and Grégory F. Schneider, *Advanced Materials*, 2017, 29(6), 1603610.

7. Rupture index: A quantitative measure of sub-micrometer cracks in graphene.

Hadi Arjmandi-Tash, **Lin Jiang**, Grégory F. Schneider. *Carbon*, 2017, 118, 556-560.

8. Graphene-stabilized lipid monolayer heterostructures: a novel biomembrane superstructure.

Lia M. C. Lima, Wangyang Fu, **Lin Jiang**, Alexander Kros, Grégory F. Schneider, *Nanoscale*, 2016, 8(44), 18646-18653.

9. Determination of isoniazid content via cysteic acid/graphene modified glassy carbon electrode.

Xiaojing Si, **Lin Jiang**, Xinyue Wang, Yaping Ding, Liqiang Luo, *Analytical Methods*, 2015, 7(2), 793-798.

10. Electrodeposited nitrogen-doped graphene/carbon nanotubes nanocomposite as enhancer for simultaneous and sensitive voltammetric determination of caffeine and vanillin.

Lin Jiang, Yaping Ding, Feng Jiang, Li Li, Fan Mo, *Analytica Chimica Acta*, 2014, 833, 22–28.

11. Facile and novel electrochemical preparation of a graphene-transition metal oxide nanocomposite for ultrasensitive electrochemical sensing of acetaminophen and phenacetin.

Lin Jiang, Shuqing Gu, Yaping Ding, Feng Jiang, Zhen Zhang, *Nanoscale*, 2014, 6(1), 207–214.

12. Mild and novel electrochemical preparation of β -cyclodextrin/graphene nanocomposite film for super-sensitive sensing of quercetin.

Zhen Zhang, Shuqing Gu, Yaping Ding, Mingju Shen, **Lin Jiang**, *Biosensors and Bioelectronics*, 2014, 57, 239–244.

13. A novel nonenzymatic fructose sensor based on electrospun LaMnO_3 fibers.

Duo Xu, Liqiang Luo, Yaping Ding, **Lin Jiang**, Yuting Zhang, Xiaoqian Ouyang, Bingdi Liu, *Journal of Electroanalytical Chemistry*, 2014, 727, 21–26.

14. Amperometric sensor based on tricobalt tetroxide nanoparticles–graphene nanocomposite film modified glassy carbon electrode for determination of tyrosine.

Lin Jiang, Shuqing Gu, Yaping Ding, Daixin Ye, Zhen Zhang, Fenfen Zhang, *Colloids and Surfaces B: Biointerfaces*, 2013, 107, 146–151.

15. Oxygen reduction reaction on nitrogen-doped graphene activated by co-doped oxygen functional groups.

Lin Jiang, Bas van Dijk, Longfei Wu, Jan P. Hofmann, Viorica Tudor, Marc T. M. Koper, Dennis G. H. Hetterscheid, Grégory F. Schneider, submitted.

16. Hydrogenation cleans up airborne contamination from graphene.

Lin Jiang, Pauline M.G. van Deursen, Hadi Arjmandi-Tash, Liubov A. Belyaeva, Haoyuan Qi, Jiao He, Vincent Kofman, Longfei Wu, Valerii Muravev, Ute Kaiser, Harold Linnartz, Emiel J.M. Hensen, Jan P. Hofmann, Grégory F. Schneider, submitted.

17. Biaxial compression of centimetre-scale graphene.

Hadi Arjmandi-Tash, Hessam Sokooti, Khosrow Shakouri, **Lin Jiang**, Alexander Kloosterman, Marius Staring, Lia M.C. Lima, Grégory F. Schneider, submitted.

18. Hydrogenated and nitrogenated graphene for field effect gas sensing.

Lin Jiang, Wangyang Fu, Elisabeth Bouwman, Grégory F. Schneider, in preparation.

Acknowledgements

I would like to thank all my collaborators who contributed to this thesis. Dr. Yuvraj Y. Birdja, Prof. dr. Marc T. M. Koper, thank you for your experimental support and the fruitful collaboration in studying the fundamental electrochemical activity of graphene. I also want to acknowledge Bas van Dijk, Dr. Dennis G. H. Hetterscheid and Prof. dr. Marc T. M. Koper for all the discussions about the electrocatalytic properties of a monolayer graphene. To Dr. Jiao He, Vincent Kofman, Prof. dr. Harold Linnartz, Dr. Haoyuan Qi, Prof. dr. Ute Kaiser, Dr. Longfei Wu, Dr. Jan P. Hofmann, Valerii Muravev, Prof. dr. Emijel J. M. Hensen for the experimental support and discussions.

Another special thank you goes to Prof. Yaping Ding, Prof. Liqiang Luo and Prof. Weiguo Cao from Shanghai University, who give a lot of help and advice for my research career. Especially, I would like to thank Prof. Ding for her support and guidance for my master study, which inspired me to go after further PhD study.

My sincere thanks also go to my colleagues and officemates. Yanina, Hadi, Amedeo, Lia, Liuba and Wangyang, thank you all for the nice, friendly and wonderful atmosphere in the lab in the starting stage of the group. Yanina, thank you for your warm, patient and kind introduction and help in the first year of my PhD. Hadi and Wangyang, thank you for the participation and guidance in my PhD projects. To Amedeo and Lia, thank you for being always so cheerful and caring for everything. I would like to thank Liuba for being a bright, brave and intelligent office mate, who inspired me a lot in life and in science. To Pauline, Erik, Alex, Xue, Xiaoyan, Weizhe, Max, Batuhan and Valeria, thank you for keeping the spirit. To Pauline and Alex, thank you for the help in translating the thesis summary. Many thanks to the other SBC-ers, Lily, Nicola, Jing, Yue, Tingxian, Ciqing, Ye, Mengjie, Ying, Wei, Aimee, Fred, Victoria, Willem, Jan, Rene, Nestor, Francesca, Panagiota, Gabriela, Bartjan, Niek, Elena, Jeroen, Geert, Dimitris, Teun, Elena, Roy, Jolinde, Roxanne, Michelle, Wim and Viorica, and all others.

I want to thank my friends. Nicole and Tom, thank you for making my life in Leiden more Dutch and more fun. Also, I want to thank Yun, Yasmine, Gang, Qing, Qiang, Xuequan, Ye, Chengyu, Yurong, Donggang, Maolin, Wanbin, Yi and Xu for the wonderful LSC community activities we made together. Thank you, Marlon and your fellows, for all the help during my stay in the Netherlands. I would also like to thank Siyuan, Yangan, Hui, Xin, Xiaoting, Jing, Kun, Yifan, Zhichao, Jichao, Gangqi, Zhiwei, Meng, Wenjing, Xiansha, Shengxiang, Chunmiao, Chen, Qingju, Silvia, Koen, Michiel, Martijn for sharing your knowledge, experience and positive energy you gave me.

Many thanks to all my nice neighbors – Zhuang, Jiaxin, Xiaobing, Jing, Peng, Jian, Zhen, Junfei, Yiran, Jialong – for all the fun and sweet neighborhood memories.

Finally, I want to thank my parents for their unconditionally love and support throughout my life. Thank you, my parents-in-law, for the understanding, respect and backing. Thank you, Nana, for your accompany and for being my sister. Last but not the least, I want to express my gratitude and love to my soulmate, Feng, who knows me better than anyone else, who inspires me to be a better person, who accepts and believe in me even when no one else would. And thank you my dear lovely son, Mingze, for making me the happiest mother in the world.

