

LUYAO LIU

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EDUCATION

Master of Physical Chemistry (*colloidal crystal*), 2021.9- 2024.6 (Expected)

East China Normal University

Courses: Advanced physical chemistry, Colloidal crystal chemistry

Bachelor of Chemistry, **East China Normal University** 2017.9- 2021.6

Courses: Organic chemistry, inorganic chemistry, physical chemistry, polymer chemistry, electrochemical analysis and applications

RESEARCH EXPERIENCES

PU to decorate fabrics for construct structural color fabrics with high crystallization 2023.2-Now

- Utilized PU to change chemical properties and microstructures of polyester (PET) fabrics, which led to decrease of permeability and increase of hydrophobicity
- Hindered the penetration of the colloidal solution which is sprayed on the surface of the fabric, causing the colloidal particles to mainly aggregate on the upper layer of the fabric after drying at 70 °C
- Formed high intensity ($R_{\max} > 10\%$) photonic color fabrics on satin and sateen polyethylene terephthalate fabrics which preserves the breathability (75% compared to raw fabrics) and flexibility of the fabric

Green synthesis of structural colored fabrics by spraying aqueous colloidal solutions ^[1] 2022.7-2023.1

- Developed a one-step spraying method to prepare SiO₂/PET fabrics with saturated and uniform structural colors by using an aqueous solution of SiO₂ particles ($R_{\max} > 15\%$)

Precise Assembly of Highly Crystalline Colloidal Photonic Crystals inside the Polyester Yarns ^[2] 2021.9-2022.3

- Developed spray coating synthesis for breathable and durable fabrics with saturated structural colors ($R_{\max} > 20\%$) as the precise colloidal assembly in the yarn avoids the blocking of weaving holes and cracks
- Developed high-performance fabrics with PC modification using a solvent with optimal surface tension and boiling point for the colloidal solution, based on the fabric parameters of low twist angle, large weave cycles, and large tightness

Nitrogen and sulfur-enriched porous bithiophene-melamine covalent organic polymers for effective capture of CO₂ and iodine ^[3] 2019.10-2020.10

- Constructed a new nitrogen and sulfur-enriched organic framework (TPFM) by one-pot Schiff-base type reaction without any catalysts and post-treatment procedure by low-cost bithiophene and melamine
- Utilized TPFM's pore channels with abundant -NH groups to absorb carbon dioxides in an effective adsorption capacity with 77.5 cm³·g⁻¹ (about 16 wt%) at 273 K
- Obtained fast and efficient iodine adsorption capacities of 293.3 mg·g⁻¹ in cyclohexane solution owing to donated lone pair electrons in S and N atoms on TPFM

Multifunctional N-S doped porous carbon material derived from melamine thiophene 2018.10-2019.10

- Used thiophene formaldehyde and melamine as raw materials to prepare a nitrogen-sulfur co-doped porous carbon material by thermal conversion
- Improved the material properties through metal coordination optimization to obtain N and S element doping of COFs to conduct a highly active electrocatalyst that is modified without the metal

Ultrafine Cu₆Sn₅ nanoalloys supported on nitrogen and sulfur-doped carbons as robust electrode materials for oxygen reduction and Li-ion battery ^[4] 2019.3-2019.11

- Prepared ultrafine Cu₆Sn₅ nanoalloys supported on porous N and S-doped carbons (Cu₆Sn₅@N-S-Cs) through annealing Cu-Sn-contained covalent organic frameworks (COFs)
- Utilized Cu₆Sn₅@N-S-Cs to catalyze oxygen reduction reaction (ORR) in both alkaline and acidic media, demonstrated high catalytic performance. with half-wave ORR potential ($E_{1/2}$) of 0.86 V in 0.1 M KOH and 0.67 V in 0.1 M HClO₄
- Developed Cu₆Sn₅@N-S-C as a capacitor with the electrochemical lithium ion storage capacity of 905 mA h g⁻¹ in an initial discharge at the current density of 50 mA g⁻¹

Sn(OH)_x-assisted synthesis of mesoporous Mn-porphyrinic frameworks and their carbon derivatives for electrocatalysis ^[5] 2018.5-2019.3

- Formed a new mesoporous organic framework by a Schiff-base-type reaction
- Obtained a catalyst for oxygen electroreduction in both alkaline and acidic media with half-wave potential reaching 0.86 V in 0.1 M KOH, with a very low yield of HO₂⁻ (4.02%) and better durability

PUBLICATIONS

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- [1]. **Liu Luyao**, He Yuying, Fu Qianqian, Ge Jianping*. *Green synthesis of structural colored fabrics by spraying aqueous colloidal solutions*. Journal of East China Normal University (Natural Science), 2023, 1: 41-49. 2023.2
- [2]. Yuying He, **Luyao Liu**, Qianqian Fu, Jianping Ge*. *Precise Assembly of Highly Crystalline Colloidal Photonic Crystals inside the Polyester Yarns: A Spray Coating Synthesis for Breathable and Durable Fabrics with Saturated Structural Colors*. Advanced Functional Materials, 2022,32(24): 2200330. 2022.3
- [3]. **Luyao Liu**, Chunmei Song* and Aiguo Kong*. *Nitrogen and sulfur-enriched porous bithiophene-melamine covalent organic polymers for effective capture of CO₂ and iodine*. Material Letters, 2020,227: 128291. 2020.10
- [4]. Xiaoying Zhang, **Luyao Liu**, Jiaxin Liu, Tingting Cheng, Aiguo Kong,* Yu Qiao, Yongkui Shan*. *Ultrafine Cu₆Sn₅ nanoalloys supported on nitrogen and sulfur-doped carbons as robust electrode materials for oxygen reduction and Li-ion battery*. Journal of Alloys and Compounds, 2020, 824: 153958. 2020.5
- [5]. Xiaoying Zhang, **Luyao Liu**, Yu Qiao, Jiaxin Liu, Aiguo Kong* and Yongkui Shan*, *Sn(OH)_x-assisted synthesis of mesoporous Mn-porphyrinic frameworks and their carbon derivatives for electrocatalysis*. Dalton Transactions, 2019, 48 (39): 14678-14686. 2019.10

COMPETITION

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- Asian Universities Student Entrepreneurship Ideation Challenge (AUSEIC) Competition** 2021.12
- **Description:** Focused on education backward areas, provide a combination of online and offline education resource assistance model, and committed to breaking the problem of educational information barriers in poor areas
 - **Achievement:** Won the second prize of the East China Normal University internal selection competition

VOLUNTEER WORKS

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- Miaomiao Reading Instruction Activities in Maqiao Experimental School** 2019.10
- **Description:** Guide students to read children's picture books and talk about some extra knowledge about stories to broaden their perspectives and to inspire their interests
- Tianjie Community Volunteer activities to provide free tutoring to the children of migrant workers** 2019.9
- **Description:** Accompany primary school students to solve learning problems, whose parents have low educational backgrounds and are migrant workers, and these parents do not have time to accompany their children to solve educational problems
- Education Helps Social Practice Activities** 2017.8
- **Description:** Provide free extracurricular enrichment programs, such as aerobics, modular programming, board games, and stage plays, to mentor middle school students in regions with underdeveloped science and technology and educational resources

AWARDS

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- Excellent student cadre at the School of Chemistry and Molecular Engineering(TOP10%) 2022.11
 - The First Prize of ECNU Elite Class Scholarship (TOP 5%) 2020.11
 - National Encouragement Scholarship (Top 13%) 2019.11
 - The First Prize of ECNU Elite Class Scholarship (TOP 5%) 2019.11
 - The First Prize Scholarship of ECNU (TOP 10%) 2018.11

SKILLS&HOBBIES

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- Tools: Origin, 3DMax, C4D, PS, Pr, Git
 - Hobbies: Jogging, Baking, Watching Formula 1 Grand Prix and documentaries