

## Lyuming PAN

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### Education

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M.E.	Tsinghua University, Major: Instrument and Meter Engineering (Jun 2022)	GPA	3.7/4.0
B.Sc.	Tsinghua University, Major: Vehicle Engineering (Jun 2019)	GPA	82/100

### Research Interests

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- Metal-based batteries and redox flow batteries
- Fuel cells and energy storage

### Publications

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- **LM Pan**, DF Chen\*, PC Pei\* et al. A novel structural design of air cathodes expanding three-phase reaction interfaces for zinc-air batteries. *Applied Energy* 2021;290:116777.
- DF Chen, **LM Pan\***, PC Pei\* et al. Carbon-coated oxygen vacancies-rich  $\text{Co}_3\text{O}_4$  nanoarrays grow on nickel foam as efficient bifunctional electrocatalysts for rechargeable zinc-air batteries. *Energy* 2021;224:120142.

### Patents

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- PC Pei, **LM Pan** et al. Preparation method and device of magnesium alloy anode material  
Authorized Announcement Number: CN108649212B
- PC Pei, **LM Pan** et al. Metal air battery catalyst, air electrode and preparation method  
Authorized Announcement Number: CN110676470B
- PC Pei, **LM Pan** et al. Air electrode and its preparation method and metal air battery including air electrode. Applied Announcement Number: CN110676466A

### Research Experiences

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#### Synthesis of bifunctional $\text{Co}_3\text{O}_4$ -based catalysts using defective engineering

*Student Researcher*, Tsinghua University, Supervisor: *Prof. Pucheng Pei* Aug 2018–Jun 2019

- **Methods:** Prepared Carbon-coated oxygen vacancies-rich  $\text{Co}_3\text{O}_4$  nanoarrays by hydrothermal reaction, plasma treatment and calcination. Used the method of SEM, XRD, TEM, EDS, RDE and EPR to characterize the material properties and catalytic activity.
- **Results:** The peak power density of zinc-air battery with proposed catalysts was 52.8% higher than that of untreated  $\text{Co}_3\text{O}_4$ . Coated carbon protected vacancies and prolonged cycle life to 358 h.

#### Novel structural design of air cathodes for zinc-air batteries increasing power output

*Research Assistant*, Tsinghua University, Supervisor: *Prof. Pucheng Pei* Jul 2019–Feb 2021

- **Methods:** Designed and fabricated air cathodes with novel structures which make three-phase reaction interfaces expand from 2D plane to 3D zone. Verified the electrochemical performances by LSV, EIS and constant current discharge.
- **Results:** A peak power density of  $120 \text{ mW}\cdot\text{cm}^{-2}$  for zinc-air battery is achieved with  $\delta\text{-MnO}_2$  as catalysts when the loading is  $1.0 \text{ mg}\cdot\text{cm}^{-2}$ . Compared with previous reports, this work shows higher power density per catalyst loading.

### Honors

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- Scholarship for Outstanding Students, Tsinghua University 2019-2020

### Reference

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- Pucheng Pei (*Prof.* Tsinghua University, CSICE Branch Vice Director, pchpei@tsinghua.edu.cn)
- Ying Dong (*Assoc. Prof.* Tsinghua University, CSMNT Senior member, dongy@tsinghua.edu.cn)