# Liquefiying Gas Electrolyte by Capillary Condensation at Ambient Pressure for Extreme Low-Temperature Batteries

**PI**: Zheng Chen, Assistant Professor
Department of NanoEngineering
University of California, San Diego

**Collaborators:**
Shirley Meng, Tod Pascal
University of California, San Diego

**Email**:
zhengchen@ucsd.edu

**Web**:
zhengchen.eng.ucsd.edu

## Research Objective

1) Develop lithium batteries that can deliver high performance at temperature lower than -40°C.

2) To adopt hydrofluorocarbon (HFC)-based gas electrolytes that will be liquefied at ambient pressure by capillary condensation in nanoporous hosts.

3) Lay out the theoretical and materials foundation for low pressure liquified gas electrolyte.

4) Fabricate prototype cells to prove the feasibility of design concept.

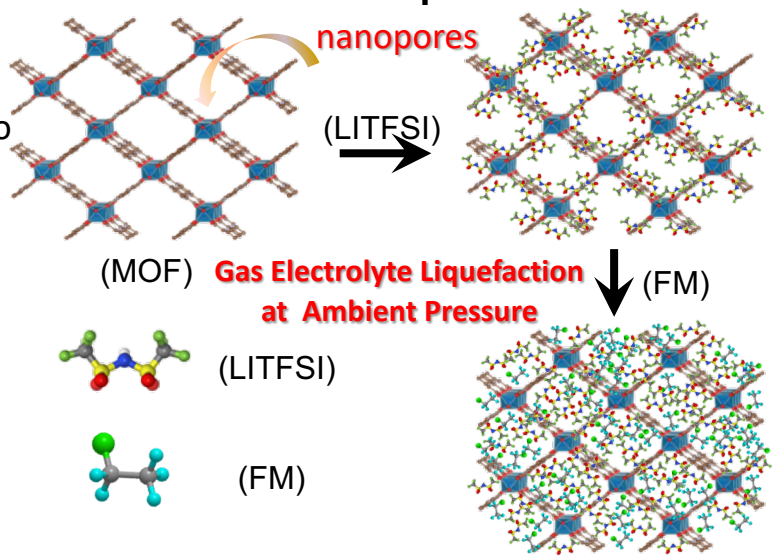


Figure 1. Schematic illustration of ambient pressure liquefaction of hydrofluorocarbon-based gas electrolytes using MOFs for extreme low temperature batteries.

## Approach

1) Integrate coordination chemistry (MOFs), fundamental electrochemistry, advanced characterization and theoretical modeling

2) Hypothesis-driven test on gas molecules behavior in nanoporous hosts at ambient pressure to create new electrolytes platform to fabricate future generations of batteries for extreme low temperature operation.

## Potential Impact

1) Develop a new class of low-temperature electrolytes, and lead to major breakthrough in boosting battery performance.

2) Offer longer duration missions with increased power capability to support NASA's exploration tasks.

3) Generate understanding of condensation behavior of HFC molecules in nanopores.

4) Open up new opportunities of high performance batteries for harsh environments .