YANGYUL JU, Ph.D.



Postdoctoral fellowship of Polymer Science and Engineering

Department of Polymer Science and Engineering, Chonnam National University, Republic of Korea

RESEARCH & COLLABORATION PROFILE

KEY WORDS: Fluid rheology, Multiphysics modeling, Silicon anodes, Polymer composites

Research Snapshot. A multi-disciplinary researcher specializing in complex fluid rheology, soft matter, and advanced energy storage materials. Combines rigorous experimental non-linear rheology (LAOS, SPP) to probe dynamic interparticle/ionic networks with advanced multiphysics modeling (COMSOL & MATLAB) to simulate chemo-mechanical stress and transport phenomena across domains.

RESEARCH EXPERTISE

- **Complex Fluid Rheology & Structural Networks:** Non-linear viscoelasticity (LAOS, SPP analysis), bulk rheology, and gelation/recovery mechanics of multi-component particle suspensions.
- **Multiphysics & Multi-scale Modeling:** Electro-chemo-mechanical coupling via COMSOL and percolation modeling via MATLAB.
- **Advanced Functional Materials:** High-capacity silicon anodes (SWCNT networks, binder chemistries) and thermally resilient nanocomposite battery components.

RECENT RESEARCH HIGHLIGHTS

- **Evaluated the synergistic effects** of binder chemistries and micro-silicon particle sizes on the stability and network dynamics of SWCNT-dispersed anode slurries (Carbon Energy, 2026).
- **Integrated experimental findings with COMSOL Multiphysics** to simulate and validate the structural, interfacial, and rheological behaviors of complex energy pastes.

POTENTIAL COLLABORATION RESEARCH

Best-fit collaborator areas:

- 1. **Multi-scale rheological modeling** of complex soft matter and functional battery slurries (Linking non-linear rheology and continuum multiphysics modeling for multi-component systems).
- 2. **Interfacial electro-chemo-mechanics and structural degradation mitigation** in high-capacity anodes (Managing chemo-mechanical stress and volumetric expansion in silicon/alloy anodes).
- 3. **Sustainable waste-to-materials and advanced functional polymer composite design** (Developing circular-economy manufacturing routes and eco-friendly binder systems).
- 4. **Advanced spectroscopic and operando diagnostics for energy storage interfaces** (Unraveling real-time ion/electron transport via operando Raman, XPS, and EIS-DRT).

SELECTED RECENT PUBLICATIONS

- **Carbon Energy, 2026; e70280 —** Engineering Mechanically Adaptive Nanonetworks for Long-Life and High-Capacity Silicon Anode Batteries
- **Journal of Energy Storage 127 (2025) 116957 —** Towards dendrite-free lithium-ion batteries: A comprehensive review of functional separator technologies
- **International Journal of Energy Research (2025) 8876732, 15 —** Engineering Polyethylene Separators With Graphene Oxide-Polyhedral Oligomeric Silsesquioxane Nanocomposites for Enhanced Thermal Resilience and Electrochemical Performance

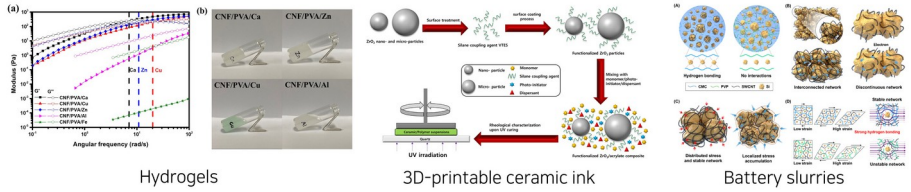
CONTACT

yyul5430@jnu.ac.kr | +82-10-5430-9605-

https://yangyul-ju.github.io/index.html

REPRESENTATIVE RESEARCH FIGURES / SCHEMES

Complex fluid rheology & Structural Networks (Experimental Physics)



Hydrogels | 3D-printable ceramic ink | Battery slurries

Multiphysics & Multi-scale Modeling (Numerical Simulation)

