

Technology Area: Polymer membranes for batteries and fuel cells

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- Description of Technology:
 - Phase separated, rod-coil block copolymers and organically modified silicon polymers, both with combination of good ionic conductivity and mechanical properties
- Potential Applications:
 - Solid polymer electrolytes (SPE) in lithium batteries; proton exchange membranes (PEM) for fuel cells
- Relevance to Space Exploration:
 - Typical battery and fuel cell applications for NASA include planetary orbiters, landers and rovers, geosynchronous orbiting and low-earth orbiting spacecraft, astronaut equipment and RLVs
 - Lithium batteries utilizing SPE offer a factor of two reduction in mass and a factor of four reduction in volume of the energy storage system, enhanced system reliability and flexibility, and lower life-cycle costs.
 - PEM fuel cells potential for 10X power density improvements over lithium batteries and concomitant reduction in mass and volume of the power system.
 - Polymer electrolyte with suitable performance is enabling technology in both power systems.
- Industry Co-developers and Industry Consumers:
 - Case Western Reserve University expertise in fuel cell and battery testing
 - Chemsultants (Mentor, Ohio) fabricating fuel cell MEAs and electrolyte film
 - Ferro (Independence, Ohio) developing manufacturing technology of rod-coil polymers
 - Daychem (Dayton, Oh) working on technologies to improve conductivity and want to get into battery business (GATE Proposal, plan to license technology)
 - Eveready Battery Company evaluating membranes for consumer batteries
 - Teledyne testing of fuel cell stacks, membrane electrode assemblies (MEAs)
 - Other manufacturers outside Oh will also be consumers of Ohio products/technology (Avestor, LTC, Inventek, Ballard, Millenium, Plug Power, GM, etc.)
- Current TRL Level: 3 (laboratory demonstration: coin cells, single cell fuel cells and MEAs)
- Technical Risks Associated with Implementation:
 - For batteries, Li conductivity needs to be raised (additives) for lower temp use
 - For both, durability testing in actual use

