Solid Electrolytes and Ceramics

ARPA-E IONICS Review
Manufacturing Panel
May 30-31, 2019
Dallas, TX

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Solid Electrolytes and Ceramics for SSB
Industrialization and Manufacturing Solutions – Lessons from SOFCs

Solid electrolyte

H⁺ or O²⁻

Ion Conducting Membrane

Solid oxide fuel cells (SOFC)

Saint-Gobain Stack Supported SOFC Concept

Anode

Cathode

Solid electrolyte

Solid State Battery (SSB)
Requirements for Solid Electrolytes/SSB: Gaps and Challenges
From Ideas to Business Development

Materials
- High ionic conductivity
- Low electrical conductivity
- Compatible with cathode/anode

Durability
- Durable (mechanical, chemical)
- Long term stability
- No Li-dendrite formation

Mfg. Cost
- R2R processable
- Raw material cost
- Optimized design, etc

The product (SSB) should be designed with assumptions in manufacturing process and cost for the successful industrialization!
Material Processing Platforms at Saint-Gobain Research North America

“State-of-the-art equipment from bench-top to pilot scales”

Saint-Gobain Research (SGR) North America
Northboro, MA

Raw Materials ♦ Dispersion ♦ Mixing ♦ Compounding ♦ Extrusion ♦ Lamination ♦ Embossing ♦ Wet Coatings ♦ R2R ♦ Tape/Gel Casting ♦ Injection Molding ♦ 3D Printing ♦ Thermal & Pilot Processes ♦ Finishing

Ceramics, Polymers, Abrasives, Reinforcements, Construction Products
Manufacturing of flat, layered components
Ceramics, Crystals, Polymers, Fabrics, Composites …
Industrialization of SOFC Cells and Stacks: 2 Approaches
With ARPA-E and EERE funding

Thermoplastic extrusion

XX% less labor and tact time

US-DOE funding: ARPA-E INTEGRATE SHIFT
Technology Showcase at ARPA-E Summit in Denver (July 2019)

SM-R2R multilayer coating process

XX% cost and energy reduction

US-DOE funding: Advanced Manufacturing Projects for Emerging Research Exploration
AMO Peer Review in Arlington, VA (Jun 2019)
Multi-material 3D structure capabilities: Lab-Prototype-Pilot scales
Scale-up and industrialization capabilities

- Co-extrusion
- Profile Extrusion
- Embossing
- Lamination
- 3D Printing / AM
Perspectives of partnership and collaboration in Industrialization

• **Innovation** “the valley of death”

• **Solutions**?

• **Collaboration with industrial partner(s)?**
  - Expertise
  - Equipment
  - Experience
  - More…

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