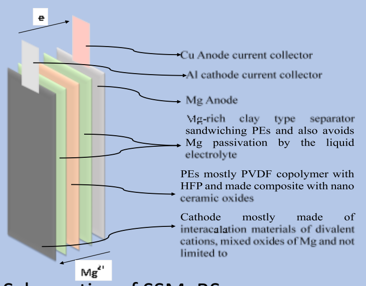
Solid – State Magnesium Batteries (SSMgBs)

Problem addressed

- Dependency on scarce resources
- High production cost
- Low ion conductivity in solid sate electrolytes.
- Limited recyclability and reusability of existing technologies.
- Issues related to dendrite formation and ion loss.
- Capacity loss and reduced performance over the time
- Cycle instability
- Safety concern
- Thermal instability



Schematics of SSMgBS

Application

- ✓ E-mobility
- ✓ Electronic applications
- ✓ Stationary storage applications
- ✓ Toys
- ✓ Drones

Inventor(s):

Kaushik Palicha
Harinipriya Seshadri

505, Fifth Floor Delta Wing,
Raheja Towers, Anna Salai,
Chennai, Tamil Nadu - 600002

Intellectual Property:

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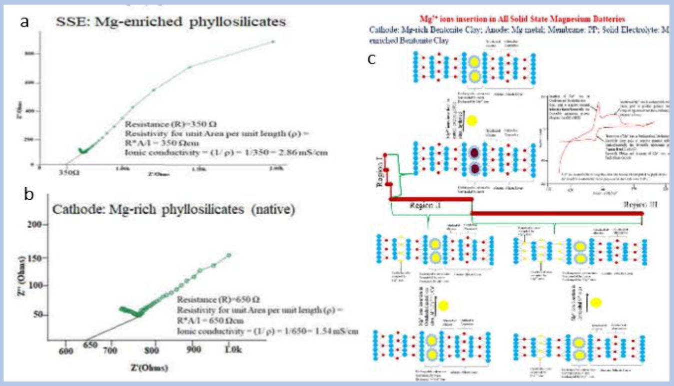


Figures
a) Ionic conductivity of SSE
b) Ionic conductivity of Cathode
c) Illustration of the Mg^{2+} ions insertion/de-insertion process in cathode active material (CAM) and Solid-state-electrolyte (SSE) of the SSMgB.

Technology:

The current technology is a solid-state Magnesium silicate battery (SSMgBs) made with locally available phyllosilicate. The battery comprises of:

1. **SSE:** Mg-enriched Bentonite Clay deposited on either side of PP membrane
2. **Cathode**: The Magnesium (Mg) rich material is coated on a cathode current collector
3. **Anode:** Metallic-Mg mixed with Polyvinylidene fluoride (PVDF) binder is coated on an anode current collector.

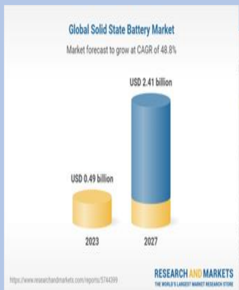
Category of the invention:

- ✓ Electrical
- ✓ Clean Energy
- ✓ Battery Technology
- ✓ Next Generation Transportation
- ✓ Green Technology

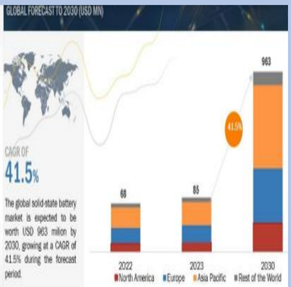
Advantage

- ✓ Mg^{2+} conductivity at room temperature,
- ✓ Low over-potential for Mg^{2+} plating/stripping,
- ✓ Fast solid phase diffusion of Mg^{2+} ions in SSE and CAM,
- ✓ Safety and dendrite-free reversible Mg electrodeposition
- ✓ Utilization of earth abundant and naturally available material
- ✓ Environmentally friendly,
- ✓ Simple, cost-effective synthesis of CAM and SSE,
- ✓ Excellent cyclability.
- ✓ High Specific capacity .
- ✓ Non chemical reactivity of the CAM and the SSE
- ✓ High electrochemical stability

Potential Value



Source:www.researchandmarkets.com



Source: www.marketsandmarkets.com

USP

- ✓ Specific capacity of up to 1176.53 mAh/g
- ✓ Cycle stability of up to 10,000 Cycles.
- ✓ Kinetically Favored Cathode with Areal capacity ≥ 10 mAh/cm^2
- ✓ Gravimetric Energy Density of 0.297 kWh/kg i.e close to SOTA of 0.45KWh/kg
- ✓ Cycle stability up to 5000 cycles at higher C-rates (5c and 10C).
- ✓ Fast & Reversible Redox process
- ✓ Mg^{2+} ionic conductivity of 2.86mS/cm and that of Mg-rich Bentonite clay cathode material as 1.45mS/cm
- ✓ Potentially low cost, high energy, high cyclable and safe.

Reach Us:

Dr. Amaresh Panda
Lead, Technology Transfer Office, KIIT-TBI
amaresh@kiitincubator.in | +91-9819053408

Dr. Samuel Rout
Manager, Technology Transfer Office, KIIT-TBI
samuel@kiitincubator.in | +91-7735389456

tto@kiitincubator.in | tto.kiitincubator.in