Novel Cost-effective Electrical Energy Storage Device Strategies for Hybrid Electric Vehicles and "Smart" Grids

Technology/Capability Overview

- The increasing demand to provide cost effective and efficient energy storage strategies to meet the growing demand of transportation and the consumer market driving the current Li-ion technology to be more competitive($$/ kWh of stored energy) and sustainable for future. Need to explore alternative, Mg based "green, low cost" battery technology.
- Commercial Li-ion batteries are ubiquitous and used in consumer and portable electronic devices to transportation industries. Current technology aims at developing amorphous Si thin films anodes by low cost electroplating technique which will offer five-fold increase in Li-ion battery charge storage.
- Considering depleting source and increasing cost of Li, Mg based rechargeable battery system is a promising alternative due to its relative abundance, and better safety characteristics. Mg can theoretically generate twice the capacity compared to Li-ion, and in turn can offer higher volumetric specific capacity (3832 mAh/cc for Mg vs. 2062 mAh/cc for Li) has a potential to substitute Li-ion packs in future.

Industry Significance

- **Si thin film anode developed** from this technology is devoid of binders and conductive agents which are typically used in graphite based anodes, thus saving on the weight of inactive ingredients, processing time and costs. A Tesla Roadster with its battery pack containing the Silicon film anode will add 117 miles more to its driving range.

- Mg based battery developed from this technology is environmentally benign, offers an economical solution for electrical energy storage with an extremely small carbon footprint, and the potential to replace lead acid battery for land based grid application.

Benefits to Partner

- **Low cost Silicon** anode developed by facile electroplating route is scalable with the potential to reduce the manufacturing costs by ~ $ 10-12/KWh while providing higher capacity than the current state-of-the-art anode for Li-ion batteries.

- Prototype **Mg cell using novel electrolyte, and Chevrel** phase cathode shows practical specific capacity ~ 80 mAh/g, tremendous potential to improve further the specific capacity using novel coating strategies.

Opportunity

Seeking company to partner, seed funds and license the innovation.

Development Status

- Mg 2016 coin cell tested with novel electrolyte, Mo_6S_8 cathode developed by new cost effective routes with Mg metal anode showing energy density ~ 70 Wh/kg

- The Silicon film anode delivers a capacity of 1200 – 1400 Ah/kg, (> 5 times graphite), at the same time reducing the 1st cycle irreversible loss to < 40% (currently ~ 60%)

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