Aerogel-Ionic Liquid Hybrid Electrolytes, Phase I Project

SBIR/STTR Programs | Space Technology Mission Directorate (STMD)

ABSTRACT

NASA energy storage requirements for extended human and robotic missions to space require energy generating systems with high specific energy, high volumetric efficiency, greater reliability, reduced parasitic impedance, and low cost/ease of manufacture. Current lithium ion batteries cannot meet the energy requirements of these missions. Lithium-air batteries, where lithium directly reacts with air can potentially have specific energy in the range of in the order 5.2 X 103 Wh kg−1. Realizing such high performance metrics however requires significant advances in component design. The electrolyte to be used in lithium air batteries, for example, must be compatible with lithium metal, and have high ionic conductivity in the order of 10-3 Siemens/cm to achieve the promised performance metrics. MMI proposes a novel aerogel-supported ionic liquid electrolyte with very high ionic conductivity for use as electrolyte in high performance lithium air batteries. With ionic conductance in the range of milli-Siemens/cm, this electrolyte, when combined with appropriate electrodes can potentially be used to fabricate lithium air batteries with specific energies as high as 500 Wh/kg and volumetric energy densities in the order of 700 Wh/L.

ANTICIPATED BENEFITS

To NASA funded missions:

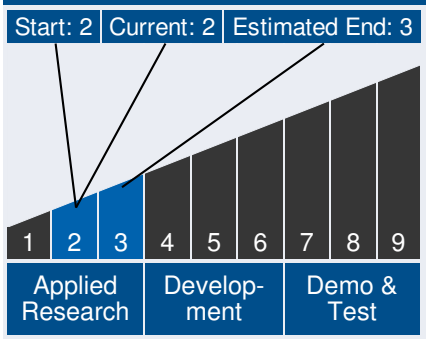
Potential NASA Commercial Applications: Rechargeable batteries are used in numerous NASA applications. NASA's crew exploration vehicles, crew launch vehicles, lunar orbiters, rovers and landers, probes and impactors, astronaut tools and extra vehicular equipment require rechargeable batteries with high energy densities and the lithium air batteries will find use in such missions.

To the commercial space industry:

Potential Non-NASA Commercial Applications: Lithium ion batteries are ubiquitous now in commercial, industrial, medical and military applications ranging from electronics to vehicular

Table of Contents

Technology Maturity



Management Team

Program Executives:

- Joseph Grant
- Laguduva Kubendran

Program Manager:

- Carlos Torrez

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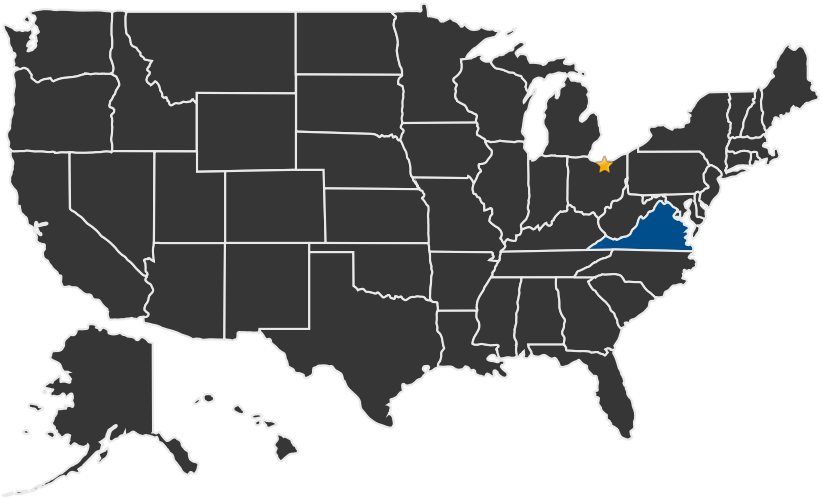
power. Future advanced applications require higher power capacity and batteries that are superior to lithium ion batteries, such as lithium air batteries hold much promise in these applications.

U.S. WORK LOCATIONS AND KEY PARTNERS



U.S. States With Work

Lead Center:
Glenn Research Center

Other Organizations Performing Work:

- Materials Modification, Inc. (Fairfax, VA)

PROJECT LIBRARY

Presentations

- Briefing Chart
  - (http://techport.nasa.gov:80/file/23368)

Management Team *(cont.)*

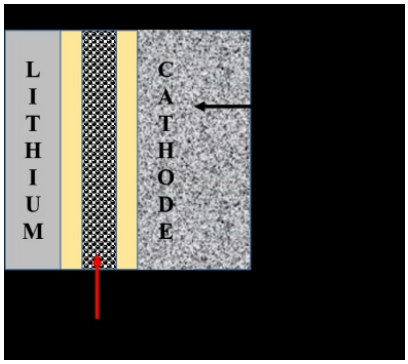
Principal Investigator:

- Krishnaswamy Rangan

Technology Areas

Primary Technology Area:
Space Power and Energy Storage (TA 3)
└ Energy Storage (TA 3.2)
  └ Batteries (TA 3.2.1)

IMAGE GALLERY



Aerogel-Ionic Liquid Hybrid Electrolytes, Phase I

DETAILS FOR TECHNOLOGY 1

Technology Title

Aerogel-Ionic Liquid Hybrid Electrolytes, Phase I

Potential Applications

Rechargeable batteries are used in numerous NASA applications. NASA's crew exploration vehicles, crew launch vehicles, lunar orbiters, rovers and landers, probes and impactors, astronaut tools and extra vehicular equipment require rechargeable batteries with high energy densities and the lithium air batteries will find use in such missions.