Solid-State Batteries

Information Paper

Manufacturing Division
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Foreword

Rechargeable lithium-ion batteries based on the emerging solid-state technology offer higher capacities and lighter weights than the standard lithium-ion technologies in use today. For the consumer this offers a significant increase in safety. For the military, it means less weight required to meet mission requirements.

To avoid the mistakes of the past and to become a leader, rather than late adopter of this emerging technology, U.S. federal government needs to develop and implement, with adequate funding, a strategy by which this technology can become and be maintained as a domestic capability from its research and development phase through mass production.
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Paper Disposition

This paper will be made available on the National Defense Industrial Association website as a reference resource: https://www.ndia.org/divisions/manufacturing/resources. Permission is granted to widely distribute and quote this paper with proper attribution.

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Members of the Manufacturing Division reviewed this paper prior to its publication. For more information about the Manufacturing Division, including a list of upcoming events, please visit NDIA.org/Divisions/Manufacturing

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Table of Contents

Information Summary

The Problem

Virtually every hand-held device in use today, from cell phones to the military's tactical radios, contain lithium-ion cells manufactured in China. Even those few domestic cell producers are reliant on a China dominated supply chain. This reliance on a foreign source of supply, especially one that is not considered an ally, is a very real threat to both the domestic economy and the readiness of our Armed Forces. Should this chain be broken, it would result in a loss of domestic jobs during normal times and have a devasting effect on the military's ability to complete their mission during a period of national emergency. This vulnerability is only going to increase as the United States moves to a greener economy and the military's reliance on advanced battery technologies to assure dominance on the battlefield. The U.S. government has acknowledged the critical role minerals and upstream sectors play in our nation's security through Executive Orders, international agreements, and congressional action on critical minerals, but much more is required. These attempts to solve this problem have been "point solutions" that lacked either adequate funding or a long term, stable strategy to assure a "cradle to grave" solution.

The Solution

Trying to develop a domestic supply chain and production capacity that would be competitive with the huge advantage China has in place for existing lithium-ion technologies would be an exercise in futility. The US cannot currently compete with China and could not spend money fast enough to catch up at this point. The only way for the US to become a world leader in the production of advanced lithium-ion battery technologies, rather than just the world leader in the consumption of these technologies, is to focus on promising technologies that are still in the basic research and development phase but are acknowledged to have a large upside for commercial and military applications. One such technology is the solid-state lithium battery. There are several reasons for selecting this technology as one for adoption:

- There is a rather large body of research that has already been conducted on the basic technology that can be leveraged
- Solid-state batteries have demonstrated the potential for higher capacities with greater safety then commercial lithium-ion batteries in use today.
- Solid-state batteries are already being made for very small devices like hearing aids.
- The same basic technology can be used in both small form factor (for consumer electronics) as well as larger formats for use in EVs.

Solution Recommendations

- Provide access to a combination of public and private funding to accelerate the domestic production of solid-state batteries through the:
    - Development of standardized performance and safety testing protocols as accepted metrics for measuring success and comparing technologies
    - Funding of basic research into innovative solutions
    - Investigation into innovative solutions to minimize production start-up costs
    - Design for recycling to reduce the dependence on non-domestic supply chain
- Establish a consortium of private companies, academia, government representatives and/potential funding sources (e.g. venture capitalists) with the mandate to:
    - Share information
    - Establish a strategy with quantifiable metrics and milestones

    - Recommend funding levels and where/how the funding should be invested
- Provide incentives for establishment of domestic production and supply chain

We believe continued and expanded funding allocated towards solid-state batteries addressing these topics will put the U.S. on a leadership path in the energy storage race. The global battery industry is projected unanimously to do nothing but grow for the next 50 years, with factories set to run without end. The potential for job growth, energy security, a circular economy, and overall economic prosperity is palpable. Not only can the Administration and Congress play an active role in this process, but companies, consortiums, professionals, and volunteers alike can support solid-state development efforts, regardless of differences in technology, and benefit. We are at the precipice of a revolutionary opportunity, and we are aware of our shortcomings and the risks before us, but we have the resources and all we need to do is apply ourselves. Solid-state ***will be*** the next battery revolution and we can either choose to lead it or wait for others to solve it and hope they will be our friends later.

About the MPSC

The mission of the Military Power Sources Committee (MPSC) is to provide a forum by which, its members can present a unified voice for critical energy storage issues. The Military Power Sources Committee (MPSC), which consists of organizations that design, develop, and manufacture power sources, for the Department of Defense, alongside such organizations as NATTBatt and the Battery Materials Technology Coalition (BMTC), believes strongly that the U.S. requires a robust, domestic energy supply chain, especially as it pertains to Lithium-ion batteries, and that the U.S. must invest in domestic materials and manufacturing technologies to ensure continued, uninterrupted prosperity.

For more information about the committee and our activities, please contact James Trevey at jtrevey@forgenano.com. or Marc Gietter at sagelyconsultant@gmail.com. Whether you agree or disagree, provide us feedback so we continue to refine our goals as we pursue them since future U.S. dominance in advanced battery technologies benefits all of us.