MUREP Small Business Technology Transfer (M-STTR) Planning Grants

Title: Graphene-based Aircraft Batteries
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SUMMARY: Nano Unmanned Aerial Systems (nUAS; <150 g) need higher energy storage and cycle life exceeding 150 dis/charge cycles. We propose a lithium-ion battery (LIB) that meets these requirements by using a novel graphene nanoribbon (GNR) anode chemistry. State of the art LIB technology achieves 265 Whkg-1 specific energy and 1,000 dis/charge cycles, but graphene can achieve a theoretical 2,232 Whkg-1 specific energy and 10,000 dis/charge cycle. Our approach will be to model LIB energy storage using GNR anodes via the Simultaneous Battery and Capacitor Design Model (SIMOD) and to model LIB cycle life degradation using SIMOD's complimentary cycle life model. We will repeat this work on LIBs made with polyamide-based graphene anodes and graphite anodes in order to compare another graphene material and an established anode material as a control. These results will determine optimal LIB designs using graphene anodes for us to prototype. Prototypes' energy storage and cycle life will be tested in wind tunnels and vibrators in accordance with relevant military and performance standards (MILSTD). Results will demonstrate a graphene-based LIB that is well-suited to the nUAS mission, achieving at least 400 Whkg-1 and 150 cycles.