

High Energy Battery Materials at Low Temperatures for Future NASA Missions

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This NASA project aims to improve the development of robust and lightweight rechargeable batteries with high energy and power density, high-capacity retention, long cycle life, and reduced safety issues at low temperatures. This project investigates the electrochemical performance of lithium-ion batteries with advanced high-capacity electrodes under extreme conditions for application in spacecrafts. The research team includes scientists from the University of Nevada, Reno, the University of Nevada, Las Vegas, and the Desert Research Institute. The team aims to understand how to mitigate performance degradation, improve the kinetics of diffusion and reaction at -60°C , and prevent potential battery fires. The scientists have developed a series of computing and experimental approaches and systematically performed simulations and experiments at multiple scales to investigate controlling mechanisms in electrochemical cycling of high-capacity lithium-ion batteries. The below photo shows the team from the Desert Research Institute measuring toxic gaseous and particulate pollutants emitted from Li-ion battery fires. Their findings will be critical for the design of smoke detectors, respirators, fire extinguishers, and post-fire cleanup strategies for space applications. Through this project and the established collaboration with NASA scientists, the team designs and develops infrastructure to test batteries at low temperatures and perform fire safety research in Nevada.