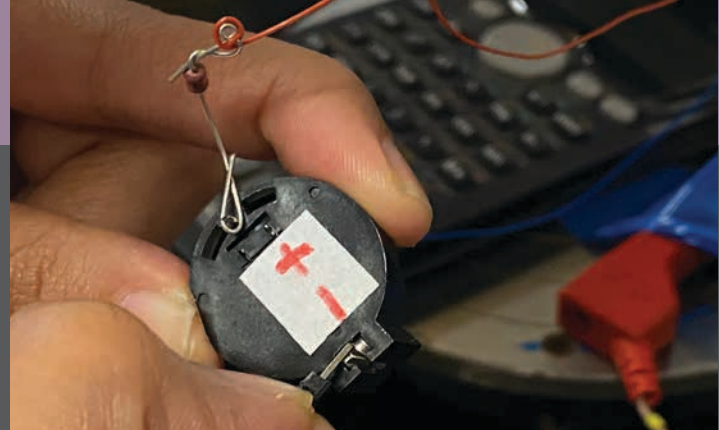


High-Performance, Sustainable and Cost-Effective Na-Ion Battery Systems



Problem Statement: Renewable energy sources and electric vehicles are crucial to address fossil fuel depletion and environmental pollution. However, renewable resources are intermittent, making simultaneous development-cum-deployment of energy storage technologies mandatory. Therefore, it is essential to develop cost-effective, resource-friendly, safe, and sustainable alkali metal-ion battery systems beyond Li-ion battery systems. India lacks Li-sources but has abundant Na-sources, so the upcoming Na-ion systems set to replace/supplement Li-ion systems is important for India. Currently, commercial competition for Na-ion systems is less than Li-ion systems but may not remain so in a few years. The proposed system aims to develop 'full' Na-ion battery systems that have a combination of desired characteristics, such as high rate-capability, cost-effectiveness and environmental/health friendliness needed for heavy-duty applications as in electric vehicles.

Uniqueness of the Solution: The to-be-developed Na-ion battery systems will have energy and power density and safety aspects superior to the state-of-the-art systems, most of which are at the research stage. Research from this team has shown that, unlike the current commercial Na-ion battery systems, it is possible to have 'aqueous processed' electrodes because the as-developed cathode and anode materials are water-stable, allowing the use of water and water-based binders for preparing electrodes. Since the usual electrode materials are hygroscopic, they are prepared using highly toxic, hazardous and expensive chemicals such as N Methyl Pyrrolidone (NMP) and Polyvinylidene fluoride (PVDF). As an important research outcome, the use of water-stable materials will lead to the development of health/environment-friendly, cost-effective and sustainable Na-ion battery systems.

Current Status of Technology: Prototypes being developed in collaboration with some companies

Societal Impact: Cost-effective electrochemical energy storage systems significantly reduce the dependence on fossil fuels and improve the quality, flexibility and health of human life worldwide due to the use of renewable energy sources.

Patent(s): Nil

Relevant Industries: Batteries, Clean Energy, Renewables.

Faculty: Prof. Amartya Mukhopadhyay, Metallurgical Engineering and Materials Science.