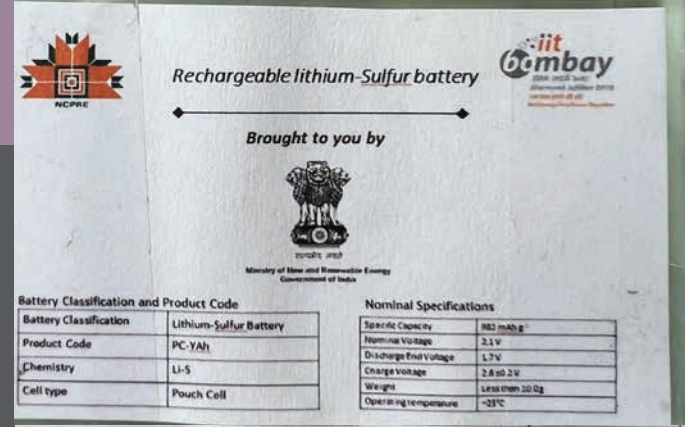


Lithium Sulphur Battery Development



Problem Statement: Lithium-sulphur batteries are considered one of the most promising alternatives to commercial lithium-ion batteries due to their high theoretical energy density (2600 Wh/kg). However, due to sluggish reactions between sulphur and lithium, Li-S batteries have poor practical capacity. Active material and the intermediate product gradually dissolve into the liquid electrolyte, so Li-S batteries lack cycling stability. Unprotected lithium anodes show parasitic reactions with the electrolytes and suffer from uncontrollable lithium dendrite growth upon repeated lithium plating and stripping. The success of the lithium-sulphur (Li-S) batteries largely relies on the direct utilisation of elemental sulphur as a cathode with protected metallic lithium as the anode.

Uniqueness of the Solution: The lithium-sulphur rechargeable batteries developed by the IIT Bombay team uses sulphur powder directly, a cost-effective way to prepare cathode material.

It uses a thin layer of lithium as the anode. It is safe despite using lithium. It can be used in lower temperatures (lower than 5°C) without much thermal management. Except for lithium, all materials are available in India, reducing the dependency on imports. The battery offers about thrice the power density than the current lithium batteries at the same power output. Cathode preparation is facile and cost-effective; the battery shows stable cycling performance and adequate practical cell capacity. The technology is scalable to bulk production of Li-S batteries.

Current Status of Technology: Lab-scale cell fabrication and coin cell testing are completed. Currently, two-layer pouch fabrication and testing are going on.

Societal Impact: Li-S battery uses sulphur as an active cathode, eliminating the dependency on elements like cobalt and Nickel. The energy density Li-S battery is 2-3 times higher than a

commercial lithium-ion battery, reducing the distance anxiety of electric vehicles. Indigenous technology will save time and cost for local production. Workforce training in new technology will benefit India.

Patent(s): Filed

Relevant Industries: Batteries, Clean Energy, Renewables.

Faculty: Prof. Sagar Mitra, Energy Science & Engineering.