

Departmental Seminar

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Seminar Title	: A Review of Recent Innovations in Battery, Super Capacitors, and Battery-Super Capacitor Hybrid Energy Storage Device Technologies
Speaker	: Rayavarapu Venkata Sai Lokesh (120ch0639)
Supervisor	: Dr. Tapas Das (8895811049)
Venue	: Old Seminar Hall, Department of Chemical Engineering
Date and Time	: 19 Jan 2024 (04:00 PM)
Abstract	: Batteries can store excess energy; however, their lower power density and low-temperature range restrict their use in some instances. Supercapacitors can be the alternative solution, lasting millions of cycles. In addition, it provides access to a broader temperature range, but its energy density is marginal compared to that of batteries. Thus, it is imperative to significantly increase the energy and power density capacities of energy storage devices. Consequently, it is possible to create a Battery-Super capacitor Hybrid device with a higher cell voltage from 3 to 4.5 V and more capacity by substituting one of a symmetric Super capacitor's capacitive electrodes for a battery electrode. The hybrid device's specific energy density will increase to 20 Wh kg <sup>-1</sup> , which could match typical Super Capacitors with a power density above 10 kW kg <sup>-1</sup> . This review discusses the fundamental scientific principle, structure, and classification of battery-operated semiconductors (BSHs). It reviews recent advances in various existing and emerging BSHs, such as Li-/Na-ion BSHs, acidic/alkaline BSHs, redox electrolytes, and pseudo-capacitive electrodes. It also looks at recent progress in hybrid devices with specific functionalities of flexibility and transparency and aqueous high voltage window with integrated 3D electrode/electrolyte framework.