




ONLINE LECTURES

The Science Behind Electric Vehicles for Transport

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Online Lecture Series

“The Science Behind Electric Vehicles for Transport”

Date: 21 July 2025

Organized by TWAS Central & South Asia Regional Partner (TWAS CASAREP), Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Bengaluru in Association With Indian Institute of Science (IISc), Bengaluru, India.

As part of its continued commitment to foster scientific learning and promote sustainable innovation, TWAS-CASAREP organized an engaging Young Scientists’ Online Lecture Series on the topic “The Science Behind Electric Vehicles for Transport”. This one-day event brought together distinguished scientists and emerging researchers to explore the scientific foundations, technological challenges, and future directions of electric vehicle (EV) technologies.

The session was initiated by Dr. Jaishri Sanwal Bhatt in the gracious presence of Prof. V. Krishnan, former President of JNCASR. She invited Prof. G.U. Kulkarni, immediate past President of JNCASR and Coordinator of TWAS-CASAREP, to deliver the opening remarks and share brief messages highlighting the importance of such dialogues for young scientists.

Following the opening remarks, Prof. Umesh Waghmare, President of JNCASR, extended a warm and heartfelt welcome to the distinguished colleagues joining from the TWAS Regional Office in Trieste, Italy, as well as to all eminent speakers and participants.



Prof. Krishnan, Prof. Sampath, and Dr. Jaishri Sanwal Bhatt



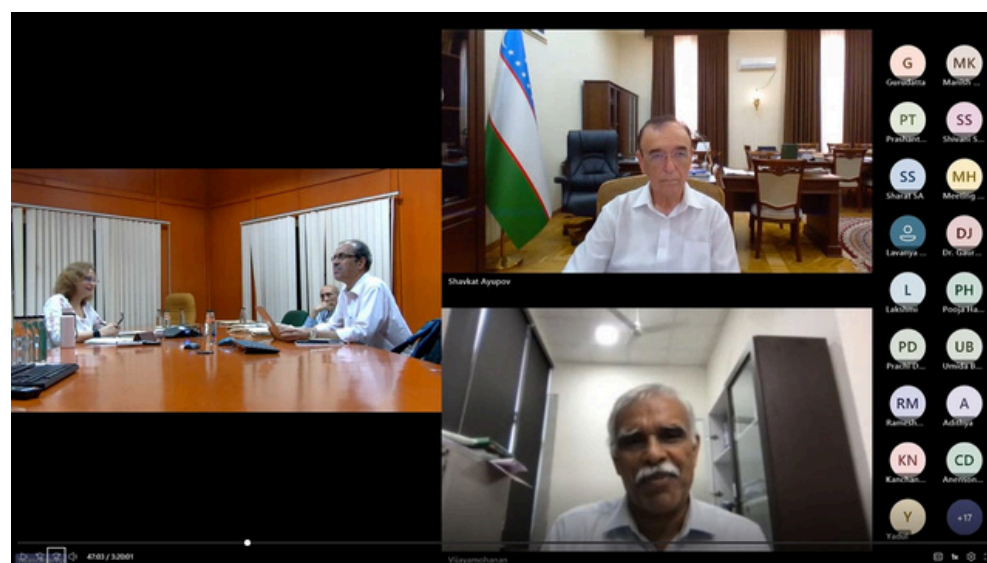
Prof. G.U. Kulkari and Prof. Umesh Waghmare

Prof. Waghmare emphasized the significance of green energy transitions and invited Prof. S. Sampath from Department of Inorganic and Physical Chemistry, Indian Institute of Science, Bengaluru, a leading expert in electrochemical energy systems, to provide an insightful overview of the program. Prof. Sampath also played a key role in coordinating the event.



Scientific Session Highlights

The event featured four keynote lectures by eminent researchers at the forefront of materials science, battery technology, and sustainable mobility. These sessions provided valuable insights into current innovations and future directions for electric vehicle (EV) systems.



Prof. Vijayamohan K. Pillai and Prof. Shavkat Ayupov

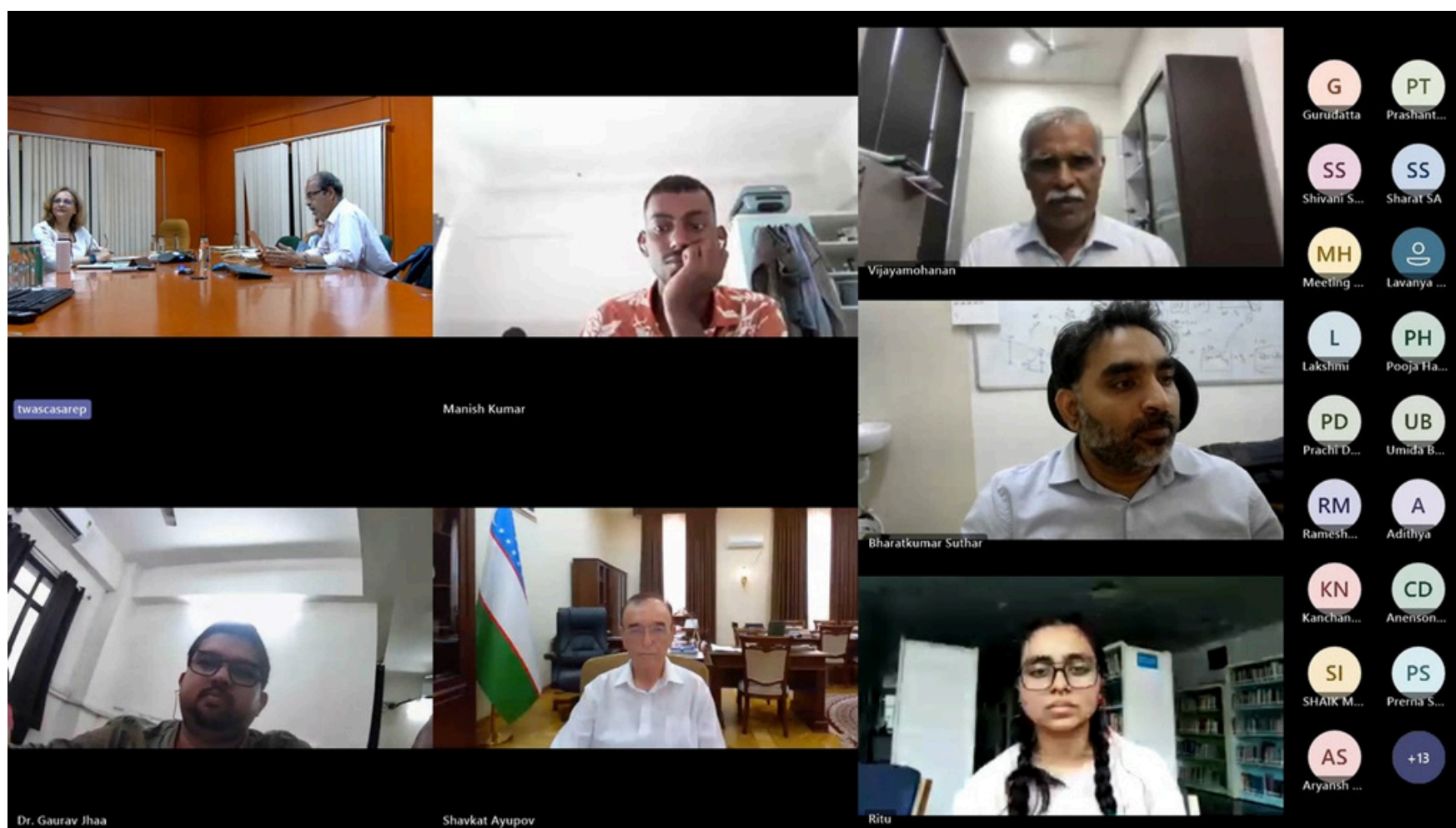
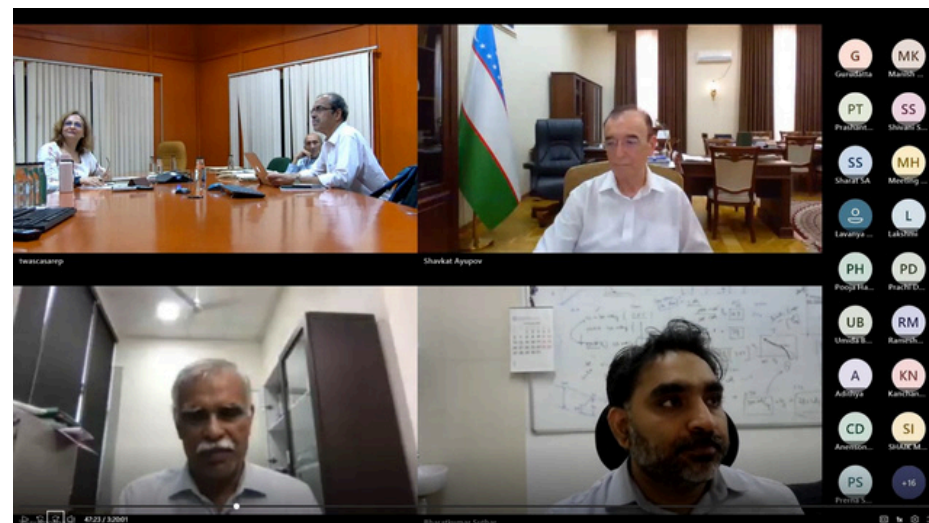


Prof. Vijayamohan K. Pillai, Dean of R&D at IISER Tirupati, delivered a lecture titled "Materials-Related Challenges for Designing More Affordable and Safer EV Batteries with Better Carbon Footprint." Prof. Pillai addressed the critical materials challenges in next-generation battery design, with a focus on solid-state sodium-ion batteries. Highlighting recent advances, he introduced composite thin films based on cellulose nanocrystals and laponite clay, which exhibit promising electrochemical performance. These developments point toward cost-effective, safer, and environmentally sustainable battery technologies leveraging earth-abundant materials.





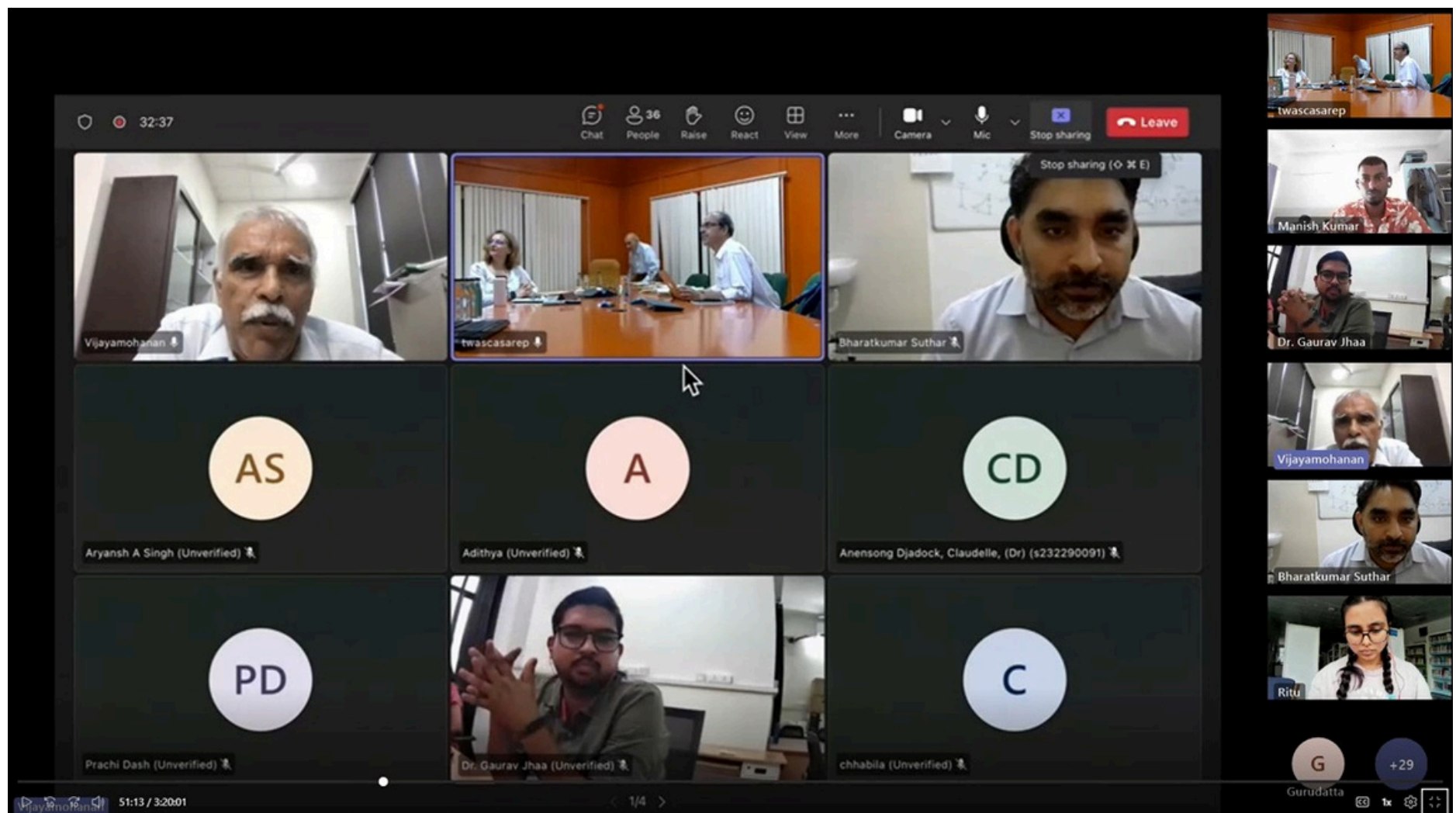
Prof. Bharat Suthar, Department of Chemical Engineering, IIT Bombay, presented "Powering the Future: A Gentle Introduction to Battery Technology for Electric Mobility." His talk provided a comprehensive overview of lithium-ion battery systems used in EVs, covering cell chemistries such as NMC and LFP, cell formats (cylindrical, prismatic, pouch), and thermal and charge management strategies. Prof. Suthar emphasized the importance of electrochemical modelling in optimizing fast-charging protocols and safety parameters, offering young scientists a solid foundation in both the theoretical and applied aspects of EV battery engineering.



Prof. Bharat Suthar, Prof. Vijayamohan K. Pillai, Prof. Shavkat Ayupov, and the young participants - Mr. Manish Kumar, Dr. Gaurav Jha, and Ms. Ritu



Prof. R. Ravikrishna, Department of Mechanical Engineering, IISc Bengaluru, spoke on "Hybrid Electric Vehicle Technologies." His lecture analysed the lifecycle emissions and techno-economic assessments of various mobility platforms including hybrids, fuel-cell vehicles, and battery-electric vehicles. By presenting India's projected transport transition roadmap, Prof. Ravikrishna highlighted the strategic relevance of hybrid EVs as transitional technologies. He further elaborated on system architectures, implementation barriers, and the need for synchronized technological and policy interventions to realize India's sustainable transport ambitions.



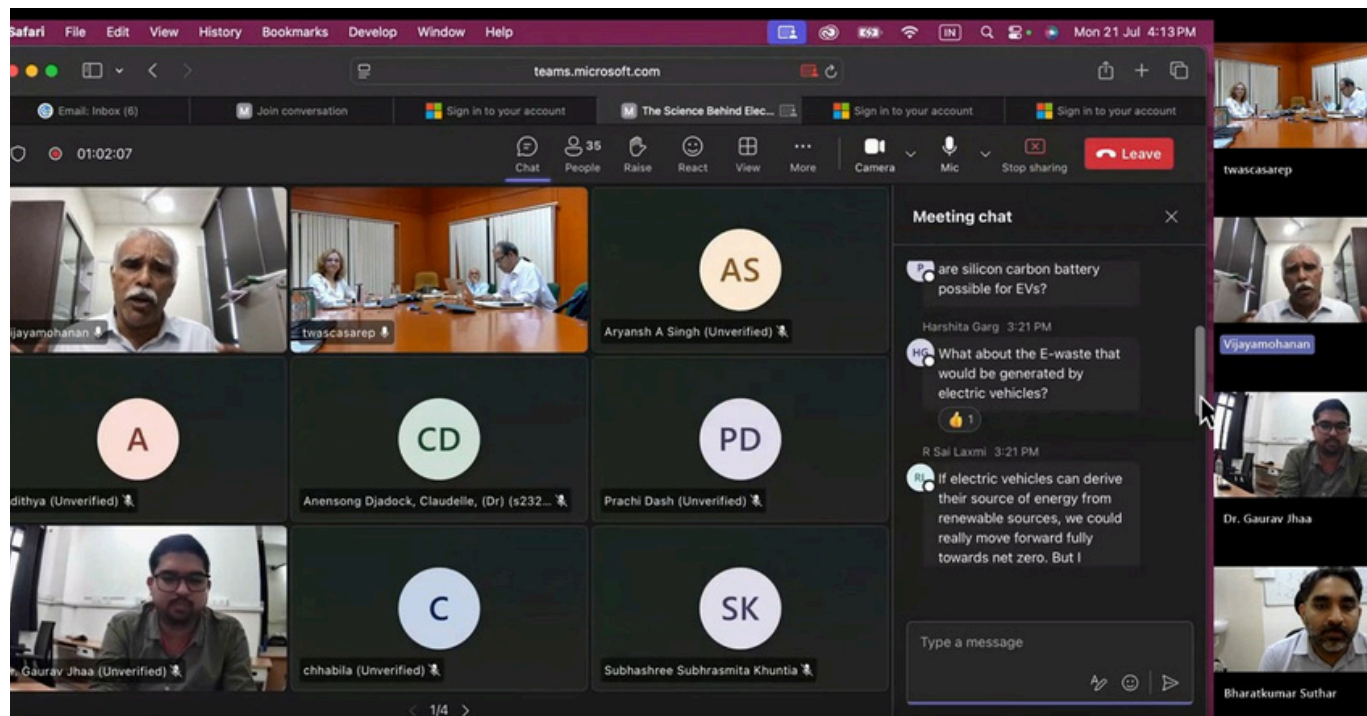


Prof. Premkumar Senguttuvan, New Chemistry Unit & ICMS, JNCASR, concluded the session with his lecture titled "Sodium-Ion Batteries for EVs: Cost-Effective Energy Storage for Sustainable Transportation." Prof. Senguttuvan showcased sodium-ion batteries (SIBs) as scalable alternatives to lithium-ion systems, emphasizing their relevance for energy security and affordability in resource-constrained settings. His presentation covered the development of high-rate cathode materials, innovative solid electrolytes, and practical cell configurations. He underscored the strategic potential of sodium-based systems in driving the green energy transition through the use of widely available materials.



Prof. Premkumar Senguttuvan, Prof. Krishnan, Prof. S. Sampath, and Dr. Jaishri S. Bhatt






Conclusion and Acknowledgments

The lecture series concluded with an open discussion session, where speakers addressed questions from the audience, offering clarity and deeper insights into battery safety, lifecycle performance, and commercialization challenges. The event was attended by over 50 early-career researchers, with strong participation from young scientists across the region. Special thanks were extended to Prof. S. Sampath for his remarkable coordination and to Mr. Dileep for providing flawless technical support throughout the session.

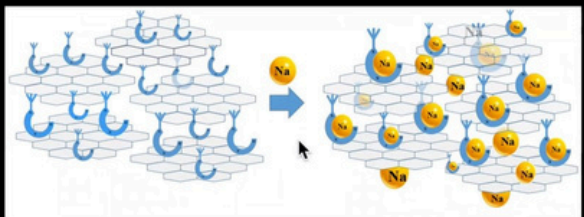
"Materials-related Challenges for designing More Affordable and Safer EV Batteries with Better Carbon Foot-print"

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The Science Behind Electric Vehicles for Transport
 Date: 21st July 2025 (14:30 to 17:30 Hrs. IST)
 Organized by
 TWAS Central & South Asia Regional Partner (TWAS-CASAREP)
 Jawaharlal Nehru Centre For Advanced Scientific Research, Bengaluru
 in Association with
 Indian Institute of Science, Bengaluru, India



V-gap Engineered Graphene Oxide Using Selective Protection of Mono-Boc-Ethylenediamine as Anode for SIB




Intercalation of Na-ions on the surface of GO-EnBoc increases the v-gap from 9.7 to 13.17 Å facilitating more Na⁺ ions characterized by using ¹³C-MAS NMR, XPS, XRD, IR, Raman and DFT Calculations -different types of Na⁺ ions - The coin cell fabricated with this anode - consistent reversible capacity of 170 mAhg⁻¹ at 25 mA g⁻¹

Journal of Energy Storage 73 (2023) 109237

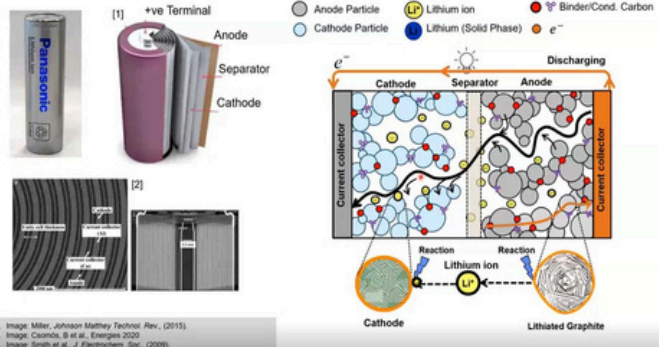
Powering the Future:
 A Gentle Introduction to Battery Technology for Electric Mobility

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Bharat Suthar | Chemical Engineering | IIT Bombay | 21.07.25

Workings of a Li-ion Cell



1. Image: Miller, Johnson Matthey Technol. Rev., (2015).
 2. Image: Coombs, B et al., Energies 2020
 3. Image: Smith et al., J. Electrochem. Soc., (2006).

Bharat Suthar | Chemical Engineering | IIT Bombay | 21.07.25

Hybrid Electric Vehicle Technologies and Their Relevance to India

Prof. R. V. Ravikrishna
 Dept of Mechanical Engineering, IISc



13/06 / 3:00PM

Perception : Electrification is the solution for transport decarbonization
 R&D spending and policies are skewed heavily towards ZEVs

Efficiency improvements
 Super Truck 55% BTE

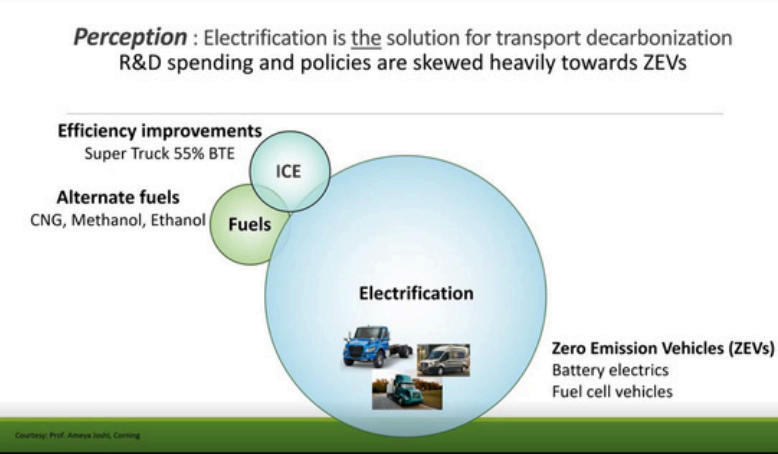
Alternate fuels
 CNG, Methanol, Ethanol

Fuels

ICE


Electrification

Zero Emission Vehicles (ZEVs)
 Battery electrics
 Fuel cell vehicles




Courtesy: Prof. Aranya Joshi, Cornell

15/06 / 3:00PM




TWAS-CASAREP On-line meeting
"The Science Behind Electric Vehicles for Transport"

Sodium-ion Batteries for EVs: Cost-Effective Energy Storage for Sustainable Transportation




Prof. Premkumar Senguttuvan
Jawaharlal Nehru Centre For Advanced Scientific Research, Bangalore, India.

CONTACT US



21st July 2025



Alexandro Volta

01 Zn | Cu cell

02 Lead Acid battery

03 Nickel-Cadmium Batteries

04 Zinc/air

05 Lithium Ion Battery

1970

Evolution of Battery Technologies

Moving Forward

This event marks another milestone in TWAS CASAREP's mission to promote scientific collaboration and capacity-building in frontier technologies. By focusing on clean energy transitions and sustainable transport, TWAS-CASAREP aims to continue providing platforms for knowledge-sharing and regional visibility.