



SRM

INSTITUTE OF SCIENCE & TECHNOLOGY
(Deemed to be University u/s 3 of UGC Act, 1956)

Faculty Development Programme on Clean and Sustainable Energy (virtual mode)

(CSE-2022)

26 - 31st December 2022

Organized by

Department of Chemistry

College of Engineering and Technology

SRM Institute of Science and Technology

Kattankulathur, 603 203

Tamilnadu, India

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CONVENER

Dr. M. Arthanareeswari

Professor and Head

Department of Chemistry, SRM IST

Email: hod.chy.ktr@srmist.edu.in

CO-CONVENERS

Dr. Manab Kundu, Res. Assoc. Prof.

Email: manabmk@srmist.edu.in Dr. G.

Maduraiveeran, Res. Assoc. Prof. Email:

maduraig@srmist.edu.in

Dr. Prasant Kumar Nayak, Res Assist. Prof.

Email: prasantn1@srmist.edu.in

Dr. Priyadip Das, Res. Assoc. Prof.

Email: priyadip@srmist.edu.in

CSE-2022

26 - 31st December 2022

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ABOUT THE INSTITUTION

SRM Institute of Science and Technology is one of the top ranking universities in India with over 52,000 students and 3,200 faculty members, offering a wide range of undergraduate, postgraduate, and doctoral programs in Engineering, Management, Medicine, Health sciences and Science and Humanities. It has established itself as a premier centre for teaching, research and industrial consultancy in the country. It has world class infrastructure including smart classrooms, hi-tech labs, advanced instruments and equipments, research laboratories, modern library and Wi-Fi facility. Ministry of HRD, Govt. of India placed SRMIST in category 'A++'.

ABOUT THE DEPARTMENT

Department of Chemistry, SRM Institute of Science and Technology has been engaged in opening up the fascinating world of Chemistry to students since 1985. The Department is supported by DST FIST, Govt. of India. The Department is offering B.Sc. (Chemistry), M.Sc. (Chemistry) and Ph.D. (Chemistry) programs. It has 55 faculty members whose areas of expertise and research include organic, inorganic, physical, analytical, environmental, electrochemistry and nanotechnology. The faculty members of the department have contributed to academics by publishing books, research articles in high-impact peer-reviewed journals, presenting papers in conferences delivering guest lectures and invited talks. The Department has tie-ups with recognized academic institutions, industries and R&D laboratories for student projects, training and research activities.

WORKSHOP THEME

Demand of energy, an essential of industrialization and economic progress, is predicted to upsurge in forthcoming. Owing to increasingly severe environmental pollution and the extreme deficiency of energy resources, harvesting clean and sustainable energy from the environment is a scientific, effective, and essential key in the coming intelligent era. The world's energy future is anticipating clean and sustainable sources at a reasonable cost without any adverse effects. At this juncture, Department of Chemistry, SRM IST would like to organize a Faculty Development Programme (FDP) to enable faculties to develop functional nanomaterials for clean and sustainable energy applications. This programme will be beneficial for the faculty members interested in diversifying clean energy technologies. The key topics include Chemistry of functional nanomaterials, employment and role of nanomaterials in energy conversion and storage devices, rechargeable batteries, supercapacitors, fuel cells, photovoltaics, and green hydrogen generation will be delivered by the eminent speakers.

LIST OF EXPERT SPEAKERS

Dr. R. Balaji, IITM Research Park
Prof. Helen Annal Therese, SRM IST
Prof. P. Elumalai, Pondicherry University
Dr. K. Ananthanarayanan, SRM IST
Dr. A. S. Prakash, CSIR CECRI
Dr. V. Kumaran, SRM IST
Dr. Ragupathy, CSIR CECRI
Dr. Manab Kundu, SRM IST
Prof. Sudakar Chandran, IIT Madras
Dr. G. Maduraiveeran, SRM IST
Dr. A. K. Sahu, CSIR CECRI
Dr. Prasant Kumar Nayak, SRM IST

CALL FOR PARTICIPATION

Participants should provide their address, email id, telephone, mobile and fax numbers. Registration form should reach the Convener on or before the last date of registration. Registration fees shall be paid by online transaction or by DD drawn in favour of "Chemistry Department Association" payable at Chennai. The online transaction details / DD must be sent to the convenor along with the registration form.

For online transfer use the following details:

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A/C. no: 500101011069471

Name of Bank: CITY UNION BANK

Branch : Tambaram: IFSC : CIUB0000117

Online registration form:

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IMPORTANT DATES

FDP : 26-31st December 2022

Last date for registration: 20th December 2022

ADDRESS FOR COMMUNICATION

All communications may be sent to
Dr. Manab Kundu Res. Assoc. Prof
Email: manabm@srmist.edu.in

REGISTRATION FEES

Academic participants: 500 (INR)

Industry participants: 1000 (INR)

Department of Chemistry
SRM Institute of Science and Technology
Kattankulathur – 603203, Tamil Nadu.

Report

Six days faculty development programme on
Clean and sustainable energy (virtual mode)
(26-31st December 2022)

 SRM INSTITUTE OF SCIENCE & TECHNOLOGY (Deemed to be University u/s 3 of UGC Act, 1956)	CHIEF PATRONS Dr. T.R. Paarivendhar, Founder Chancellor Dr. Ravi Pachamuthu, Pro Chancellor (Admin) Dr. P. Sathyanarayanan, Pro Chancellor (Academics) Dr. R. Shivakumar, Chairman, SRMIST (Ramapuram and Trichy Campuses)	CSE-2022 26 - 31 st December 2022
	ADVISORY COMMITTEE Dr. C. Muthamizhchelvan, Vice Chancellor, SRMIST Dr. S. Ponnusamy, Registrar, SRMIST Dr. T.V. Gopal, Dean, CET, SRMIST Dr. A. Duraisamy, Dean, CSH, SRMIST Dr. D. John Thiruvadigal, Dean (Sciences), SRMIST Dr. B. Neppolian, Dean, Research, SRMIST	REGISTRATION FORM
Faculty Development Programme on Clean and Sustainable Energy (virtual mode) (CSE-2022) 26 - 31st December 2022	CONVENER Dr. M. Arthanareeswari Professor and Head Department of Chemistry, SRMIST Email: hod.chy.ktr@srmist.edu.in	1. Name: _____
	CO-CONVENERS Dr. Manab Kundu, Res. Assoc. Prof. Email: manabmk@srmist.edu.in Dr. G. Maduraiveeran, Res. Assoc. Prof. Email: maduraig@srmist.edu.in Dr. Prasant Kumar Nayak, Res Assist. Prof. Email: prasantnl@srmist.edu.in Dr. Priyadip Das, Res. Assoc. Prof. Email: priyadip@srmist.edu.in	2. Designation: _____
Organized by Department of Chemistry College of Engineering and Technology SRM Institute of Science and Technology Kattankulathur, 603 203 Tamilnadu, India		3. Organization: _____
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Dr. Manab Kundu, SRM IST
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Dr. Manab Kundu Res. Assoc. Prof
Email: manabm@srmist.edu.in

REGISTRATION FEES

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Figure 1: The brochure of the programme, which was circulated for inviting various institutions.

Programme Schedule

Speaker	Introducer	Title	Date	Time
Dr. A. K. Sahu, CSIR CECRI	Dr. Manab Kundu	Fuel cell technologies for automotive applications	26.12.2022	11.00 to 12.00 am
Dr. G. Maduraiveeran, SRM IST	Dr. Priyadip Das	Earth-Abundant Transition Metal-Based Nanomaterials for Improved Oxygen Evolution Reaction	26.12.2022	2.30 to 03.30 pm
Prof. P. Elumalai, Pondicherry University	Dr. G. Maduraiveeran	Supercapacitors: Basics to Recent Developments	27.12.2022	11.00 to 12.00 am
Dr. R. Balaji, IIT-M Research Park	Dr. Manab Kundu	The role of functional materials development in Realising Hydrogen Energy Technology	27.12.2022	2.30 to 03.30 pm
Dr. Sudakar Chandran, IIT M	Dr. G. Maduraiveeran	Microstructure tailored fast charging cathodes for Li-ion batteries	28.12.2022	11.00 to 12.00 pm
Dr. V. Kumaran, SRM IST	Dr. Prasant Kumar Nayak	Sustainable Electrical Energy Storage Systems: Recent Trends and Developments	28.12.2022	2.30 to 03.30 pm
Dr. Ragupathy, CSIR-CECRI	Dr. Prasant Kumar Nayak	Electrochemical Energy Systems: Great challenges and Opportunities	29.12.2022	11.00 to 12.00 am
Prof. Helen Annal Therese, SRM IST	Dr. Goutam K Kole	Development of high energy micro-supercapacitors	29.12.2022	2.30 to 03.30 pm
Dr. K. Ananthanarayanan, SRM IST	Dr. Senthil Andavan	Perovskite Solar Cells: Present Status and Future Prospects	30.12.2022	11.00 to 12.00 am
Dr. Prasant Kumar Nayak, SRM IST	Dr. Goutam K Kole	Co-free oxide based cathode materials for rechargeable Li and Na-ion batteries	30.12.2022	2.30 to 03.30 pm
Dr. Manab Kundu, SRM IST	Dr. Priyadip Das	Nanostructured transition metal derivatives for electrochemical energy storage applications	31.12.2022	10.00 to 11.00 am
Dr. A. S. Prakash, CSIR CECRI	Dr. Prasant Kumar Nayak	Indigenous Li ion Na ion batteries for Indian EV market	31.12.2022	11.00 to 12.00 pm

Currently, over three-quarters of global GHG emissions result from fuel combustion used in energy production, construction and transport. To achieve the clean energy transition, electrifying the most GHG-intensive sectors – transport and energy – is a must. Electrochemical energy storage devices, which are currently responsible for 30% of global GHG emissions reduction, can enable the clean and sustainable energy transition by helping to decarbonise transport and enable a higher uptake of renewable energy technologies. In this context, the six days FDP (26th to 31st December 2022, virtual mode) organized by the Department of Chemistry, SRMIST was highly relevant.

This programme was beneficial for the faculty members interested in diversifying clean energy technologies. The key topics included Chemistry of functional nanomaterials, employment and role of nanomaterials in energy conversion and storage devices, rechargeable batteries, supercapacitors, fuel cells, photovoltaics, and green hydrogen generation delivered by the eminent speakers.

About 50 participants registered from various institutes. The programme was well-received by the faculty members. We feel that the programme was a great success! We also plan such a programme in the future.

Prof. M. Arthanareeswari,

Head and Convener

Co-convener

Dr. Manab Kundu, Res. Assoc. Prof.

Dr. G. Maduraiveeran, Res. Assoc. Prof.

Dr. Prasant Kumar Nayak, Res Assist. Prof.

Dr. Priyadip Das, Res. Assoc. Prof.

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Priyadip Das (Guest)
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Introduction

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Owing to great energy density, eco-friendliness, safety and security, and cost effective, rechargeable metal-air batteries (MABs) have engrossed substantial devotion

Metal-Air Batteries

ORR: $\text{O}_2 + 2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2\text{O}$ (acidic) / $\text{O}_2 + \text{H}_2\text{O} + 2\text{e}^- \rightarrow \text{OH}^-$ (alkaline)

OER: $\text{H}_2\text{O} \rightarrow \frac{1}{2}\text{O}_2 + 2\text{H}^+ + 2\text{e}^-$ (acidic) / $4\text{OH}^- \rightarrow \text{O}_2 + 2\text{H}_2\text{O} + 4\text{e}^-$ (alkaline)

Schematic: Anode (M) | Electrolyte | Cathode (M)

Graph: Current density (mA cm⁻²) vs Potential (V vs. RHE). Shows ORR and OER curves with kinetic parameters E_{onset} , $E_{1/2}$, E_{onset} , and $E_{1/2}$.

OER electrodes are the bottleneck in water splitting devices and Metal-Air Batteries

Sluggish Electrode Kinetics of 4-e⁻ transfer reaction

OER mechanism for acid (blue) and alkaline (red)

Design of low-cost & high-performance of alternative OER electrode materials is a Key

Bak et al. ACS Nano 2020, 14, 14323 & Schafer et al. Chem. Soc. Rev., 2022, 51, 4583

Earth-Abundant Transition Metal-Based Nanomaterials for Improved Oxygen Evolution Reaction

Dr. G. Maduraiveeran
Research Associate Professor
Department of Chemistry
SRM Institute of Science and Technology
Kattankulathur, Tamil Nadu, INDIA

MEL Materials Electrochemistry Laboratory

FDP-CSE 2022

Dr.M.Arthanareeswari
Priyadip Das
G Maduraiveeran
D

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 ॐ नमो भगवते वासुदेवाय
 VERS LA LUMIERE

Faculty Development Programme in Chemistry
SRMIST, Chennai, December 27, 2022

Supercapacitors: Basics to Recent Developments

Dr. Perumal Elumalai
 Professor & Head
 Department of Green Energy Technology
 Pondicherry University

Dr.M.Arthanareeswari
 Prof. Perumal Elumalai
 Manab Kundu
 Manab Kundu
 Dr. Anju. K

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Dr.M.Arthanareeswari asis Manab Kundu Dipankar Das Arockia Selvi J
 Dipankar Das Arockia Selvi J

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- A. Arunchander
- Steffy N J
- Srinu Akula
- V. Parthiban
- Sumanta Das
- Prabhakaran
- Shikha Thappa

• Director, CECRI, Karaikudi
 • Scientist-in-Charge, CECRI Madras Unit

Thank you very much for your kind attention

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S Dr.M.Arthanare... (Host, me) [Microphone icon] [Camera icon]
 A asis [Microphone icon] [Camera icon]
 MK Manab Kundu [Microphone icon] [Camera icon]
 GM G Maduraiveeran [Microphone icon] [Camera icon]
 AS Arockia Selvi J [Microphone icon] [Camera icon]
 BB Baskar Baburaj [Microphone icon] [Camera icon]
 DP D. Paradesi [Microphone icon] [Camera icon]
 D Devikala S [Microphone icon] [Camera icon]
 DD Dipankar Das [Microphone icon] [Camera icon]
 Dr Goutam K Kole [Microphone icon] [Camera icon]
 A Dr N Abirami [Microphone icon] [Camera icon]
 DT Dr. T. Anand [Microphone icon] [Camera icon]
 DT Dr. T. Pushpa Malini [Microphone icon] [Camera icon]
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Priyadip Das (Guest)

Manab Kundu (Guest)

Arockia Selvi J (Guest)

Baskar Baburaj (Guest)

Devikala S (Guest)

Dipankar Das (Guest)

Dr D Paradesi (Guest)

Dr Goutam K Kole (Guest)

Dr. Anjan Bedi (Guest)

Dr. T. Pushpa Malini (Guest)

Dr.M.Sivakami (Guest)

Gopal Chandru Senadi (Guest)

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Earth-Abundant Transition Metal-Based Nanomaterials for Improved Oxygen Evolution Reaction

Dr. G. Maduraiveeran

Research Associate Professor

Department of Chemistry

SRM Institute of Science and Technology

Kattankulathur, Tamil Nadu, INDIA

MEL Materials Electrochemistry Laboratory

FDP-CSE 2022

Essence of multiphase oxide based high capacity cathode materials for rechargeable Li and Na-ion batteries

Prasant Kumar Nayak

Department of Chemistry,

SRM Institute of Science and Technology,

Kattankulathur

FDP "Clean and sustainable Energy", SRMIST (26-31/12/2022)

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SRM ETOL14

Prasant Nayak

Dhatshanamoorthy B (RC213300...)

Manab Kundu

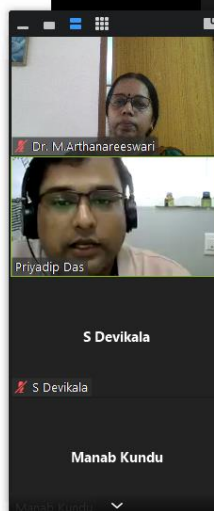
Nanostructured transition metal derivatives for electrochemical energy storage applications



Dr. Manab Kundu

Research Associate Professor
Electrochemical Energy Storage Laboratory
Department of Chemistry
SRM Institute of Science and Technology

Faculty Development Programme (FDP) on "Clean and Sustainable Energy", 26th -31st December 2022



Electrochemical Energy Systems: Great challenges and Opportunities.



Dr. P. Ragupathy, CSIR-CECRI

FDP on "Clean and Sustainable Energy"
SRMIST
Kattankulathur - 603 203
December 29, 2022



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SRM ETOL14 Prasant Nayak Dhatshanamoorthy B... Manab Kundu Tanay Kundu

Conclusions

- ❖ Importance of multiphase or integrated oxide cathode with high capacity and better cycle-life for Li-ion batteries is demonstrated.

Samples	Initial discharge capacity / mAh g ⁻¹	Capacity retention
NMC622	200	35 %
NL5050	186	83 %
NL2575	205	85 %

- ❖ Na_{2/3}Mn_{3/5}Fe_{2/5}O₂ exhibited better cycling stability when cycled in the potential range of 2.0–4.2 V with 0.5M NaPF₆ in PC electrolyte.
- ❖ The biphasic Na_{0.8}Li_{0.2}Mn_{0.6}Fe_{0.2}O₂ exhibited an initial specific capacity of about 174 mAh g⁻¹ with 82 % capacity retention after 100 cycles.

54

Participants (34)

Find a participant

- SRM ETOL14 (Me)
- Manab Kundu (Host, guest)
- Prasant Nayak (Guest)
- 832 1782 7663 (Guest)
- Aishwarya Parab RA223... (Guest)
- ANEESH ANAND (Guest)
- Anita (Guest)
- Anjeline.W (Guest)
- Baburaj Baskar (Guest)
- Dhatshanamoorthy B (R... (Guest)
- Dr Goutam K Kole (Guest)
- Dr. Anjan Bedi (Guest)
- Dr. T. Pushpa Malini (Guest)
- Ganeshpandian M (Guest)

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SRM ETOL14 Helen A. Therese Dr Goutam K Kole Kumaran V Prasant Nayak Manab Kundu

High energy density flexible architecture solid state symmetric device

Schematic diagram representing the step by step process followed for the fabrication

22 23 24 25 26

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Synopsis Meeting - Ms. Preeyanghaa in 1 minute Meeting ID: 963 1887 1267 Activate Windows Start to Settings to activate Windows.

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1 Nanostructured transition metal derivatives for electrochemical energy storage applications
Dr. Manab Kundu
Research Assistant Professor
Advanced Energy Storage Laboratory
Department of Chemistry
SRM Institute of Science and Technology

2 Based on glassy carbon electrodes

3

4

(a) Schematic diagram of the electrochemical cell setup. The cell consists of a glassy carbon electrode (GCE) modified with a layer of CuCo_2S_4 and a layer of $\text{CuCo}_2\text{S}_4/\text{OH}$. The cell is connected to a potentiostat. The redox reactions are shown as: $\text{CuCo}_2\text{S}_4 + \text{OH}^- + \text{H}_2\text{O} \rightleftharpoons \text{CuCo}_2\text{S}_4/\text{OH} + \text{H}_2\text{O} + e^-$.

(b) Cyclic voltammograms (CVs) of the GCE, GCE/ CuCo_2S_4 , and GCE/ $\text{CuCo}_2\text{S}_4/\text{OH}$ at various scan rates (10, 20, 50, 100, 200, 500, 1000 mV s^{-1}).

(c) Potential-time plots for the GCE, GCE/ CuCo_2S_4 , and GCE/ $\text{CuCo}_2\text{S}_4/\text{OH}$ at various scan rates.

(d) Bar chart showing the specific capacity (C g^{-1}) of the GCE, GCE/ CuCo_2S_4 , and GCE/ $\text{CuCo}_2\text{S}_4/\text{OH}$ at various scan rates.

(e) Cyclic voltammograms (CVs) of the GCE, GCE/ CuCo_2S_4 , and GCE/ $\text{CuCo}_2\text{S}_4/\text{OH}$ at various scan rates (10, 20, 50, 100, 200, 500, 1000 mV s^{-1}).

(f) Potential-time plots for the GCE, GCE/ CuCo_2S_4 , and GCE/ $\text{CuCo}_2\text{S}_4/\text{OH}$ at various scan rates.

(g) Bar chart showing the specific capacity (C g^{-1}) of the GCE, GCE/ CuCo_2S_4 , and GCE/ $\text{CuCo}_2\text{S}_4/\text{OH}$ at various scan rates.

Amala George, Manab Kundu, ACS Energy & Fuels 2022, 36, 19, 12327-12340

Slide 35 of 38 English (India)

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Development of high-energy micro-supercap

Helen Annal Therese

Professor, Department of Chemistry
SRM Institute of Science and Technology,
Kattankulathur, Tamil Nadu, India

Faculty Development Program, 26th - 31st Dec- Department of Chemistry, SRM IST, Kattankulathur-2022

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Zoom Meeting

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View Options

Dr.M.Arthanareeswari

Sudakar Chandran

G Maduraiveeran

Manab Kundu

Mariappan

Method I: Co-axial Electrospinning

Method II: Electrospinning Followed by Wet-chemical Coating Process

Trial No.	Reference Name	polymer for core (wt.%) / shell (wt.%)	Electrospinning conditions d = 15 cm V = 30 kV		Annealing conditions (Air)			Charge and discharge Capacity at initial cycles/ discharge capacity at high C-rate (mAh g ⁻¹)	
			Needle diameter (mm)	Flow rate (μl/min)	Heating rate (°C/min)	Temp. (°C)	Time (h)	At 0.1C	At 10C/ 20C
1	LLO-S CA10	PAN (10)/ PMMA (12.5)	0.6/1.2	38/ 40	0.6	800	3	321, 268	10C: 88 20C: 55
2	LLO-S CA10 2	PAN (10)/ PVP (10)	0.6/1.2	38/ 38	0.5	800	12	252, 216	10C: 40
3	LLO-S CA20	PAN (10)/ PMMA (12.5)	0.6/1.2	50/ 60	0.6	800	3	331, 247	10C: 50 20C: 9

Participants (56)

Find a participant

S

Dr.M.Arthanareeswari (Host, me)

SC

Sudakar Chandran (Guest)

GM

G Maduraiveeran (Guest)

MK

Manab Kundu (Guest)

AP

Aishwarya Parab RA223... (Guest)

A

Ananthanarayanan (Guest)

AA

ANEESH ANAND (Guest)

A

Anita (Guest)

A

Anjeline.W (Guest)

BB

Baskar Baburaj (Guest)

DP

D. Paradesi (Guest)

DB

Dhatshanamoorthy B (R... (Guest)

DA

Dr Goutam K Kole (Guest)

DA

Dr Abhinav Saha (Guest)

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TRANSITIONS

ANIMATIONS

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VIEW

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Shape Outline

Shape Effects

Find

Replace

Select

1

Sustainable Electrical Energy Storage Systems: Recent Trend and Development

2

Outline

3

Why we need Sustainable Energy Storage Systems?

4

Key Features of Sustainable Energy Storage Systems

5

Are they Sustainable?

6

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Sustainable Electrical Energy Storage Systems: Recent Trend and Development

Kumaran VEDIAPPAN

Department of Chemistry

SRM IST-Kattankulathur Campus

Clean and Sustainable Energy - FDP, December 26-31, 2022

SRM ETOL14

Kumaran V

Prasant Nayak

Manab Kundu

SLIDE 1 OF 46

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Microstructure tailored fast charging cathodes for Li-ion batteries

Sudakar Chandran

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Faculty Development Program –SRM - 28 Dec 2022

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Dr. M. Arthanareeswari
G. Maduraiveeran
Sudakar Chandran

Figure 2: Some glimpses of various talks during the whole programme.