AICTE Training and Learning (ATAL) Academy

Sponsored

Six Day Faculty Development Programme (FDP)

On

"Nanotechnology in Materials Science"

(Bridging Education with Research and Applications)

19-08-2024 to 24-08-2024

REPORT

DEPARTMENT OF

BASIC ENGINEERING

SAKTHI POLYTECHNIC COLLEGE

SAKTHI NAGAR – 638 315

AICTE Training and Learning (ATAL) Academy

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Six Day Faculty Development Programme (FDP)

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"Nanotechnology in Materials Science"

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Organizers

Dr. R. Kannan, **Co-Ordinator- ATAL FDP,** **Lecturer/ Physics,** **Department of Basic Engineering,** **Sakthi Polytechnic College,** **Sakthi Nagar, Erode -638 315**	**Dr. R. Jothimurugan,** **Co-Co-Ordinator- ATAL FDP,** **Lecturer/ Physics,** **Department of Basic Engineering,** **Sakthi Polytechnic College,** **Sakthi Nagar, Erode -638 315**

DEPARTMENT OF

BASIC ENGINEERING

SAKTHI POLYTECHNIC COLLEGE

SAKTHI NAGAR - 638 315

ORGANIZING COMMITTEE

Chief Patron — **Dr. M. Manickam**
Chairman
Sakthi Polytechnic College
Sakthi Nagar – 638315

Joint Patron — **Thiru. G. Muniasamy**
Correspondent
Sakthi Polytechnic College
Sakthi Nagar – 638315

Patron — **Dr. K. R. Muthuswamy**
Director
Sakthi Polytechnic College
Sakthi Nagar – 638315

Co-Patron — **Dr. S. Senthil Arasu**
Principal (i/c)
Sakthi Polytechnic College
Sakthi Nagar – 638315

Coordinator — **Dr. R. Kannan**
Lecturer
Department of Basic Engineering
Sakthi Polytechnic College
Sakthi Nagar – 638315

Co-Coordinator — **Dr. R. Jothimurugan**
Lecturer
Department of Basic Engineering
Sakthi Polytechnic College
Sakthi Nagar – 638315

CONTACT

Dr. R. Kannan +91 95247 85965
Dr. R. Jothimurugan +91 94884 52538

ABOUT THE INSTITUTION

Sakthi Polytechnic College operates under the Sakthi Foundation Trust, founded by Padma Bhushan Dr. N. Mahalingam, a renowned industrialist and philanthropist. The college's primary goal is to provide quality technical education to underprivileged rural students. College is managed by a Governing Council chaired by Dr. M. Manickam, it includes represent -tatives and experts from education and industry sectors. The institution is approved by the All India Council for Technical Education (AICTE) and is a Government Aided institution offering eight diploma programs. Recently, five of these programs received accreditation from the NBA.

ABOUT THE DEPARTMENT

The Department of Basic Engineering, a foundational department, has coexisted with the major departments since the college's inception. Initially, the department served as a bridge, transitioning students from a school education environment to a technical education platform, marking a significant academic transformation. It established a strong foundation in basic science and humanitarian education, crucial for the growth of technical students. Since its establishment, the Basic Engineering Department has maintained steady growth in all its activities, playing a key role in creating a vibrant and positive academic environment within the college through awareness programs and various events. These initiatives empower students with knowledge of recent research and technical developments. The department also contributes to the empowerment of teachers through seminars, training programs, and Faculty Development Programs (FDPs) in a phased manner.

SAKTHI POLYTECHNIC COLLEGE

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Important Dates:

Last Date of Submission : 08.08.2024

Acceptance Notification : 09.08.2024

ABOUT ATAL ACADEMY

The AICTE Training and Learning (ATAL) Academy was established in 2018 with the goal of planning and facilitating the delivery of quality technical education in India. It aims to support technical institutions by promoting research, innovation, and entrepreneurship through training in various emerging fields. Currently, there are 15 ATAL Academies, located in the AICTE camp offices across the country.

REGISTRATION GUIDELINES

- Participants must be from higher education institutes **(Engineering and Polytechnics)**.
- Applications for the FDP should be submitted online via the AICTE web portal at https://www.aicte-india.org/atal.
- Participants need to be nominated by the Head of their institution.
- An institute ID card and a No Objection Certificate (NOC) must be uploaded during the online application process.
- Only a maximum of 50 participants will be selected.
- Selection will be based on a **first-come, first-served basis.**
- There is no registration fee.
- Travel allowances will be provided, and accommodation will be arranged.

ABOUT FDP

Materials science is one of the important field of study for technical education. Particularly, in the field of Mechanical, Metallurgy, Electrical and Electronics, the knowledge on metallic materials paves the way for new and novel solutions for different needs. Adding to that nano-technology is an inter-disciplinary in nature, has the applications ranging from engineering, medicine and aerospace. It is the need of the hour to understand the role of nanotechnology in materials science research.

This FDP focuses on the recent developments in Nanotechnology in Materials Science Research and its implications in the engineering and technology. The following areas will be covered in the present FDP.

- Fundamentals of Nanotechnology
- Advanced Materials and their properties
- Synthesis and Characterization Techniques
- Role Nanotechnology in Materials Research
- Research Trends and Innovations
- Interdisciplinary Approaches
- Industry and Academia Collaboration
- Future Directions and Career Development
- Ethical and Safety Considerations
- Grant Writing and Funding Opportunities

EMINENT SPEAKERS

- **Dr. S. Karuppuchamy**, Professor and Head, Department of Energy Science, Alagappa University, Karaikudi.
- **Dr. P. Sakthivel,** Professor, Department of Nanoscience and Technology, Bharathiar University, Coimbatore.
- **Dr. K. Kadirvelu,** Scientist F, DIA-CoE-BU, Bharathiar University, Coimbatore.
- **Dr. K. Jeganathan,** Professor of Physics, Director, Centre for Nanoscience and Technology, Bharathidasan University, Trichy.
- **Dr. S. Manivannan,** Professor of Physics, National Institute of Technology, Trichy.
- **Dr. P. Premasudha,** Assistant Professor, Department of Nanoscience and Technology, Bharathiar University, Coimbatore.
- **Dr. P. Balraju,** Assistant Professor of Physics, Coimbatore Institute of Technology, Coimbatore.
- **Dr. A. Murugeswari,** Assistant Professor of Physics, Anna University, Chennai.
- **Dr. S. Renukadevi,** Professor and Head, Department of Education, NITTTR, Chennai.
- **Dr. M. Devendiran,** Application Specialist, PerkinElmer India Pvt. Ltd., Chennai.

All India Council for Technical Education

(Statutory body under Ministry of Education, Govt. of India)
Nelson Mandela Marg, Vasant Kunj, New Delhi 110 070
Website link: https://www.aicte-india.org/atal

Training and Learning Bureau
Sanction Letter

F. No. 1715853221/AICTE /ATAL/2023-24/ 15 **Date-** 24 07.2024

To

The Drawing and Disbursing Officer,
All India Council for Technical Education
Nelson Mandela Marg, Vasant Kunj,
New Delhi-110070

Sub: Release of a sum of **Rs. 2,50,000/ (Rupee Two Lakh Fifty Thousand only)** being the **first instalment of the Grant-in-Aid** under **AICTE Training and Learning (ATAL) Academy Programme** for the Academic year 2024-25 - reg.

Sir/Madam,

This is to convey the sanction of the Competent Authority of the Council for payment of **Rs. 3,50,000/- (Rupees Three Lakhs Fifty Thousand Only)** as Grant- In -Aid for conducting of Face to Face **ATAL Basic Faculty Development Programme** under AICTE Training and Learning (ATAL) Academy Programme and to make payment of Rs.2,50,000/- (Rupee two Lakh Fifty Thousand only) as first instalment of Grant-in-Aid as per details given below:

1	Name of the Beneficiary Institute (University/College/Institute)	**SAKTHI POLYTECHNIC COLLEGE**
2	Address	**SAKTHI POLYTECHNIC COLLEGE, NACHIMUTHUPURAM, SAKTHI NAGAR, APPAKUDAL, ERODE - 638315**
3	Name of the Coordinator	**Dr.R. Kannan**
4	Permanent ID of Institute	**1-445676291**
5	Title	**"Nanotechnology in Materials Science" (Bridging Education with Research and Applications)**
6	Dates of FDP	**19.08.2024 to 24.08.2024**
7	FDP Type	**ATAL BASIC FDP**
8	Total Amount Sanctioned	**Rs. 3,50,000/-**
9	Amount to be released as 1st Instalment	**Rs. 2,50,000/-**
10	Amount to be released as 2nd Instalment (Case to case basis upon submission of Statement of Expenditure)	**Rs.1,00,000/- (Cap Limit)**

The instructions/guidelines to be followed by University/Institution

I. Release of funds

a. The maximum cost for conducting per programme will be of **Rs. 3,50,000/-** as per detail given as under:

Sr. No.	Particulars	Sanctioned amount for 2024-25 for ATAL Basic FDPs
1.	Honorarium to Co-ordinator	Rs. 8,000/-
2.	Honorarium to Co-Co-ordinator	Rs. 5,000/-
3.	Honorarium for computer operators/lab-Technicians	Rs. 5,000/- (in total)
4.	Honorarium for experts	Rs. 50,000/- (Rs. 5,000 per session)
5.	TA to External experts engaging sessions	Rs. 1,00,000/-
6.	Refreshment & Lunch	Rs. 60,000/-
7.	Hands on training material, consumable items, and Miscellaneous Charges etc. reimbursed on actual basis	Rs. 22,000/-
8.	TA to Participants (excluding in-house participants)	Rs. 80,000/- (Rs. 1600 (lump sum) per External Participant payable only for those with >=90% attendance and travelling beyond 20 KM one side)
9.	Industrial Visit	Rs. 20,000/-
	TOTAL	**Rs. 3,50,000/-**

(b) The grant is subject to the adjustment on the basis of Utilisation Certificate in the prescribed proforma to be submitted by the University/College/Institution. Further, the accounts of the institute will be open for test check by the Council or Controller & Auditor General of India or any other officer designated by them.

(c) The amount of the Grant-in-Aid bill shall be disbursed and credited to the account of **SAKTHI POLYTECHNIC COLLEGE** through **RTGS**.

(d) This Grant-in-Aid is being released in conformity with the terms & conditions as well as norms of the scheme as already communicated vide the scheme document.

(e) The sanctioned grant-in-aid is debitable to the AICTE Training and Learning (ATAL) Academy Programme and is valid for payment during the **financial year 2024-25** only.

(f) Funds once released for organising the approved topic/area of FDP cannot be utilised for any other programme.

(g) In case the event is cancelled/not conducted/could not conduct due to lack of required participants on the first day first session, the Grant- In-Aid shall be **refunded to AICTE within 07 days.**

(h) In case it is revealed that any vigilance case/ grievance is pending against the institute or punitive action has been initiated against the institute for violation of AICTE norms, the Grant-In-Aid released to the institute will be liable to be refunded along **with interest @ of 10% per annum**.

2. Maintenance of Account by the Institute/University

(a) The University/College/ Institute shall maintain proper accounts of the expenditure out of the grants, which shall be utilised only on approved items of expenditure as given above.

(b) Funds covered by this grant shall be kept separately and would not be mixed up with other funds, so as to know the amount of interest accrued on the grant from AICTE.

(c) The Council or its nominee shall have the right to check/ verify the account to satisfy that the fund has been utilised for the purpose for which it was sanctioned.

(d) The Institute shall send a confirmation to AICTE within 15 days of receipt of grant on the receipt of the same.

(e) All mandatory documents **in original in hardcopy** be submitted to The Director, Training & Learning Bureau, All India Council for Technical Education, Nelson Mandela Marg, Vasant Kunj, New Delhi -110070 within **fifteen days of completion** of the FDP

II. Distribution of funds to institutions,

Amount of the grant sanctioned will be released in two instalments; first as advance of Rs. 2,50,000/- and then as reimbursement against the utilization Certificate and Statement of Expenditure, limited to Rs. 1,00,000/- to the University/Institute through electronic transfer in the account of the University/Institute after submission of mandate form.

Institute Bank Account Details

Institute PAN No.	Bank Name	Bank Branch	Bank Branch Address	Account Holder Name	Account type	Account number	IFSC Code
AABTS 4026M	SBI - STATE BANK OF INDIA	BHAVANI & Code No. 00971	735, METTUR ROAD, BHAVANI, ERODE (Dt), PIN -638301	SAKTHI POLYTECHNIC COLLEGE	Current	37069201321	SBIN0000971

III. Refund of Grant through RTGS/NEFT in favour of Member Secretary, AICTE, New Delhi

The unutilized Grant-in-Aid should be refunded to the Council **within fifteen days** of conduct of the FDP. If the university/institute does not conduct FDP on the prescribed dates, or fails to follow directions in regard to conduct of FDPs as laid out in the scheme document the entire amount will be liable to be refunded within 07 days. The amount has to be refunded to AICTE through RTGS as per details given below:

Account Number	**55113200222**
Name of the Account Holder	**Member Secretary, AICTE, New Delhi**
Bank Name	**State Bank of India**
Branch Name	**Shastri Bhawan, New Delhi**
IFSC Code	**SBIN0050203**

IV Submission of documents by University / Institution

(a) The following mandatory relevant documents are required to be submitted by the University / institution in original in hardcopy within fifteen days of the completion of the programme.

(i) Utilization Certificate (UC) as per Annexure –I of Scheme Guidelines

(ii) Statement of Expenditure (SoE) as per Annexure-II of Scheme Guidelines

(iii) Original bills

(iv) FDP Report duly acknowledged and signed by Coordinator and HoI

(b) Documents required to be uploaded in soft/scanned format in the ATAL Portal.

(i) List of participants who have successfully completed the FDP on the basis of the continuous, comprehensive assessments (in EXCEL Format).

(ii) FDP Report including photographs, YouTube links and Media report (News/Media/Magazine cuttings/clippings)

(iii) Utilization Certificate & Statement of Expenditure as per Annexure I &II

(iv). Assessment questionnaire and Results of assessment (EXCEL format)

V General Instructions

(a) Maximum 50 and minimum 30 minimum number of participants relaxed to 20 for North Eastern states Jammu, Kashmir, Laddakh and Andaman & Nicobar Islands).

(b) A test has to be conducted on the last day accordingly. Scheme document 2024-2025 and those who score more that 70% will be termed as successful candidates. Those who have attendance 80% or more and also score more that 70% in the test will be issued a digital certificate.

(c) Eligibility for institutions and participants are as laid out in the scheme guidelines

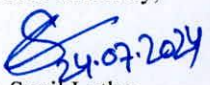
(d) No fees shall be charged from any participant for attending ATAL FDP.

(e) The institute should bear the expense incurred in addition to the fund granted by AICTE from their own resources.

(f) Terms and conditions laid out in the Scheme Guideline for ATAL FDPS 2024-25 will be final and binding.

This Sanction Letter may be treated as Offer Letter for all purposes.

Yours Sincerely,



Dr. Sunil Luthra,
Director,
Training and Learning Bureau, AICTE

Copy forwarded for information and necessary action to: -

1. **Dr.R. Kannan, Email: kannanarjun13@gmail.com**
2. **THANGAVELU NACHIMUTHU, SAKTHI POLYTECHNIC COLLEGE, NACHIMUTHUPURAM, SAKTHI NAGAR, APPAKUDAL, ERODE – 638315**
3. **Guard File**

Title of the FDP: "Nanotechnology in Materials Science" (Bridging Education with Research and Applications)

FDP Start Date: 19-08-2024 **FDP End Date:** 24-08-2024

Day 1 - 19-08-2024	**Day 2** - 20-08-2024	**Day 3** - 21-08-2024	**Day 4** - 22-08-2024	**Day 5** - 23-08-2024	**Day 6** - 24-08-2024
9:00 – 9:30 **Inauguration**					
9:30 – 12:00 **Session 1** 1. **Name of the Expert:** *Dr. K. Kadirvelu* 2. **Designation:** Scientist **F** 3. **Organization:** DIA-CoE-BU, Bharathiar University, Coimbatore. 4. **Experience in Years:** 25 5. **Topic to be taught:** Advanced Materials for Protective and sensing applications.	**9:30 – 12:00** **Session 3** 1. **Name of the Expert:** *Dr. P. Sakthivel* 2. **Designation:** *Professor, Department of Nanoscience and Technology.* 3. **Organization:** *Bharathiar University, Coimbatore.* 4. **Experience in Years: 24.** 5. **Topic to be taught:** Polymers Synthesis and Characterization Organic Light Emitting Diodes, Supercapacitor	**9:30 – 12:00** **Session 5** 1. **Name of the Expert:** *Dr. A. Murugeswari.* 2. **Designation:** Asst. Professor of Physics. 3. **Organization:** Anna University, Chennai 4. **Experience in Years:** 14 **Topic to be taught:** Nanomaterials and Magnetism	**9:30 – 12:00** **Session 7** 1. **Name of the Expert:** *Dr. P. Balraju ,* 2. **Designation:** *Asst. Professor of Physics,* 3. **Organization:** *Coimbatore Institute of Technology, Coimbatore* 4. **Experience in Years:** 15 5. **Topic to be taught:** Microscopy and micro analysis of nano structures	**9:00 – 1:00** **Industrial visit** **1. Name of the Organization:** *DRDO Industry Academia-Centre of Excellence BU - autonomous research institute* 2. **Complete address with pincode :** *Dr.K.Ganesan, Director, DIA-CoE Bharathiar University, Bharathiar University - Post, Coimbatore - 641046. Phone: +91-422-2428158 Email: drdobucls@buc.edu.in* **3. Industry Type:** *DRDO INDUSTRY ACADEMIA-CENTRE OF EXCELLENCE* 4. **Area of specification:** Characterization Instruments for the analysis of nano materials.	**9:30 – 12:00** **Session 10** *1.* **Name of the Expert:** *Dr. M. Devendiran,* *2.* **Designation:** *Application Specialist.* *3.* **Organization:** *PerkinElmer India Pvt Ltd, Chennai.* 4. **Experience in Years:** *15.* 5. **Topic to be taught:** *Role of nanomaterials for industrial instrumentation.*
12:00 – 1:00 **Article Discussion** **1.Title of the Research Paper:** A review on transfer methods of two-dimensional materials. **2. Name of the journal:** *2D Materials (IOP)* **3. Year of Publication:** *2024*	**12:00 – 1:00** **Article Discussion** **1.Title of the Research Paper:** Recent development of coloring alloys **2. Name of the journal:** Progress in Materials Science (Elsevier) **3. Year of Publication:** *2022*	**12:00 – 1:00** **Article Discussion** **1.Title of the Research Paper:** The effects of Cr addition on microstructure, hardness and tensile properties of as-cast Al–3.8wt.%Cu–(Cr) alloys **2. Name of the journal:** Journal of Materials Research and Technology (Elsevier) **3. Year of Publication:** *2020*	**12:00 – 1:00** **Article Discussion** **1.Title of the Research Paper:** *Comparative Study of Microstructural, Mechanical and Electrochemical Aspects of As-Deposited and Shock Wave Exposed Ni-W Nanostructured Coatings* **2. Name of the journal:** *Defence Science Journal* (DSJ-DRDO Journal) **3. Year of Publication:** 2022		**12:00 – 1:00** **Article Summary**
1:00 – 2:00 **Lunch**	**1:00 – 2:00** **Lunch**	**1:00 – 2:00** **Lunch**	**1:00 – 2:00** **Lunch**	**1:00 – 2:00** **Lunch**	**1:00 – 2:00** **Lunch**
2:00 – 4:30 **Session 2** *1.* **Name of the Expert:** *Dr. S. Manivannan* 2. **Designation:** *Professor of Physics.* 3. **Organization:** *National Institute of Technology, Trichy.* 4. **Experience in Years:**20 5. **Topic to be taught:** Transparent nano scale films and devices	**2:00 – 4:30** **Session 4** 1. **Name of the Expert:** *Dr. P. Premasudha,* *2.* **Designation:** *Assistant Professor* 3. **Organization:** *Bharathiar University, Coimbatore* 4. **Experience in Years:** 15 5. **Topic to be taught:** Nanobiotechnology	**2:00 – 4:30** **Session 6** 1. **Name of the Expert:** *Dr. K. Jeganathan,* 2. **Designation**: *Professor of Physics, Director, Centre for Nanoscience and Technology.* 3. **Organization:** *Bharathidasan University, Trichy.* 4. **Experience in Years:** 25 5. **Topic to be taught:** 2D layered materials for electronic, optoelectronic and energy harvesting devices.	**2:00 – 4:30** **Session 8** 1. **Name of the Expert:** Dr. S. Renukadevi, 2. **Designation:** Professor and Head, Department of Education. 3. **Organization:** NITTTR, Chennai. 4. **Experience in Years:** 25 5. **Topic to be taught:** Effective Routes for Stress Management	**2:00 – 4:30** **Session 9** *1.* **Name of the Expert:** *Dr. S. Karuppuchamy* 2. **Designation:** *Professor and Head, Department of Energy Science.* 3. **Organization:** *Alagappa University, Karaikudi.* 4. **Experience in Years:** 25 5. **Topic to be taught:** Energy Storage Materials	**2:00 – 4:00** **MCQ & Reflection Journa**l
4:30 – 5:30 **Synthesis of Nanostructured thin films through electrodeposition route**	**4:30 – 5:30** **Synthesis of Nanostructured metal thin films through electrodeposition route**	**4:30 – 5:30** **Synthesis of Nanostructured metal oxides**	**4:30 – 5:30** **Synthesis of Nanostructured metal oxides**	**4:30 – 5:30** **Surface roughness analysis using laser and MATLAB software**	**4:00 – 5:00** **Valedictory Session**

Eminent Speakers for the AICTE ATAL FDP "Nanotechnology in Materials Science"
(Bridging Education with Research and Applications)

Sakthi Polytechnic College

19.08.2024 – 24.08.2024

S. No	Name and Designation of the Expert	Photo
1.	**Dr. K. Kadirvelu** Scientist **F** DIA-CoE-BU, Bharathiar University, Coimbatore.	
2	**Dr. S. Manivannan** Professor of Physics. National Institute of Technology, Trichy.	
3	**Dr. P. Sakthivel** Professor, Department of Nanoscience and Technology. Bharathiar University, Coimbatore.	
4	**Dr. P. Premasudha,** Assistant Professor, Department of Nanoscience and Technology. Bharathiar University, Coimbatore.	
5	**Dr. A. Murugeswari.** Assistant Professor of Physics. Anna University, Chennai	

6	**Dr. K. Jeganathan,** Professor of Physics, Director, Centre for Nanoscience and Technology. Bharathidasan University, Trichy.	
7	**Dr. P. Balraju**, Assistant Professor of Physics, Coimbatore Institute of Technology, Coimbatore.	
8	**Dr. S. Renukadevi,** Professor and Head, Department of Education, NITTTR, Chennai.	
9	**Dr. S. Karuppuchamy** Professor and Head, Department of Energy Science. Alagappa University, Karaikudi.	
10	**Dr. M. Devendiran,** Application Specialist, PerkinElmer India Pvt Ltd, Chennai.	

Sakthi Polytechnic College

“Nanotechnology in Materials Science” (Bridging Education with Research and Applications)

Participants List - 19.08.2024 - 24.08.2024

S.No	Name	Email	Phone	Institute Name	Designation
1	Dr. VEERA GAJENDRA BABU. M	babuveeragajendra@gmail.com	9360529966	SANKAR POLYTECHNIC COLLEGE	Lecturer
2	Mr. ATHISIVA SELVAM N	athisivaselvam1927@gmail.com	7904969364	SANKAR POLYTECHNIC COLLEGE	Lecturer
3	Mr. B SELVASUNDARAM	selva.sundaram1@gmail.com	8148511928	SANKAR POLYTECHNIC COLLEGE	Lecturer
4	Mr. VIJAYARAJ C	vijaymetspc@gmail.com	9080038784	SAKTHI POLYTECHNIC COLLEGE	LECTURER
5	Mrs. YOGAMALAR CARUNYAM A	aycmet@gmail.com	9095294549	Sakthi polytechnic college sakthi nagar	Lecturer (senior grade)
6	Mr. GOVINDARASU P	pgmetly@gmail.com	9952646663	SAKTHI POLYTECHNIC COLLEGE	Lecturer
7	Mr. P Panneerselvam	panneerselvammaths@gmail.com	9488272744	Sakthi Polytechnic College, Sakthi Nagar	Lecturer
8	Mr. SARAVANAN S	saravananphy22@gmail.com	9976825247	NANDHA POLYTECHNIC COLLEGE	Lecturer
9	Mr. VIKRAM M	mvikrammaths@gmail.com	9597755571	Sakthi Polytechnic College	Lecturer
10	Mr. YUVARAJA J	yuvanmails@gmail.com	9042224200	SAKTHI POLYTECHNIC COLLEGE	Lecturer
11	Dr. KALAISELVI	nkarthiaarav@gmail.com	9789111334	Navarasam Arts and Science College for women	Associate Professor
12	Dr. A.SIVAPRAKASAM	greenchemistry2020@gmail.com	9788664486	ERODE SENGUNTHAR ENGINEERING COLLEGE	Assistant Professor

13	Mrs. Vidhya J	opilal@gmail.com	8667558152	M Kumarasamy College Of Engineering	Assistant Professor
14	Dr. THANGAMANI C	thangamanic.physics@mkce.ac.in	9626306383	M.KUMARASAMY COLLEGE OF ENGINEERING	Assistant Professor
15	Dr. Sivasubramanian P	sivaresearch948@gmail.com	9746251316	PTR College of Engineering and Technology, Madurai, Tamilnadu, India	Assistant Professor
16	Dr. Anand Siddeswaran	dnanapoly@gmail.com	7402672511	KSR Institute For Engineering and Technology	Assistant Professor
17	Dr. Agiladevi S	agilakarmega@gmail.com	9994743365	KSR Institute for Engineering and Technology	Assistant Professor
18	Dr. R Sengodan	sengodan.r.sci@kct.ac.in	9894045082	Kumaraguru College of Technology, Coimbatore	Assistant Professor
19	Dr. S. Inbakumar	inbakumar.s.sci@kct.ac.in	9789665388	Kumaraguru college of technology	Assistant Professor
20	Dr. MANIKANDAN MURUGESAN	drmanikandanmphy@gmail.com	8144333843	K.RAMAKRISHNAN COLLEGE OF TECHNOLOHY	Assistant Professor
21	Mr. ARIVAZHAGAN V	arivuanbu24pmu@gmail.com	9003801385	Annai JKK Sampoorani ammal polytechnic college	Senior Lecturer
22	Dr. Rajnish kumar sharma	rajnishmeest@gmail.com	8144369096	Siddhartha Institute of Engineering and Technology	Associate Professor
23	Mrs. REVATHI.M	devipranav2011@gmail.com	8838589511	EEC	Assistant Professor
24	Miss DIVYA V	divyaviji333@gmail.com	9095175692	kumaraguru College of Technology	Research scholars
25	Dr. K.V.GUNAVATHY	gunavathy.kec@gmail.com	9894947763	Kongu Engineering College	Assistant Professor (Sr.G)
26	Dr. C. Rangasami	rangasami@kongu.ac.in	9976817141	Kongu Engineering College	Professor
27	Miss DHARANI PRIYA P K	dharanipriyapk679@gmail.com	9498862340	KUMARAGURU COLLEGE OF TECHNOLOGY	Research scholars
28	Mr. Udhayanandhan P	udhayanandhan1@gmail.com	9791520446	Nandha Arts and Science College,Erode-52	PG Scholars

29	Dr. SHANMUGAM R	rsmbvned@gmail.com	9842933199	SAKTHI POLYTECHNIC COLLEGE	Lecturer
30	Miss A.Shalini	shalinisarathi2003@gmail.com	8610897779	Nandha arts and science college	PG Scholars
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AICTE Training and Learning (ATAL) Academy

Sponsored

Six Day Faculty Development Programme (FDP)

on

"Nanotechnology in Materials Science"

(Bridging Education with Research and Applications)

Inauguration

Date: 19.08.2024, Monday @ 9:30 AM **Venue: Meeting Hall**

: Lighting of Lamp

: Prayer Song

Welcome Address: Dr. R. Kannan
Lecturer/Physics

Presidential Address: Dr. S. Senthil Arasu, Principal (i/c)

Special Address: Thiru. G. Muniasamy
Correspondent

Felicitation Address: Dr. K.R. Muthuswamy, Director

Chief Guest Address: Dr. K. Kadirvelu, Scientist F
DIA-CoE-BU, Bharathiar University
Coimbatore

Vote of Thanks: Dr. R. Jothimurugan
Lecturer/Physics

: National Anthem

All are welcome

The AICTE ATAL-sponsored Faculty Development Program (FDP) on "Nanotechnology in Materials Science" was held at Sakthi Polytechnic College from August 19th to 24th, 2024. This program was designed to provide participants with a deep understanding of the role of nanotechnology in material science, emphasizing its applications, recent advancements, and the interdisciplinary nature of the field.

Introduction:

The FDP aimed to bridge the gap between education, research, and practical applications in nanotechnology and material science. It focused on equipping educators, researchers, and industry professionals with the latest knowledge and skills necessary to contribute effectively to the rapidly evolving field of nanotechnology. The program covered a broad range of topics, including the synthesis and characterization of nanomaterials, their applications in various industries, and the latest computational tools used in nanotechnology research.

Objective

- To explore the prevailing patterns and potential avenues for nanotechnology in materials science while distilling important goals into a manageable structure.
- To obtain knowledge about state-of-the-art developments, synthesis processes, and characterisation methods.
- To investigate the difficulties, prospects, and cross-disciplinary cooperation by means of talks on applications covering many industries.
- To promote a deeper comprehension of the effects of nanomaterials on the electronics, energy, healthcare, and environmental sectors.
- To equip participants with the required knowledge and abilities to effectively contribute to the expanding field of materials science and nanotechnology, while also fostering networking and hands-on training.

Outcomes

- **Enhanced Knowledge:** A comprehensive understanding of the principles of nanotechnology and its integration into materials science.
- **Practical Skills:** Hands-on experience with advanced tools and techniques used in nanomaterial synthesis and characterization.
- **Research Capabilities:** Insights into the latest research trends and challenges in nanotechnology, enabling participants to contribute to cutting-edge research.

- **Curriculum Development:** The ability to incorporate nanotechnology concepts into educational curricula, thereby improving the quality of technical education.
- **Industry Collaboration:** Strengthened connections between academia and industry, fostering collaborations that can lead to innovative applications of nanotechnology.

This program was a significant opportunity for educators and researchers to update their skills and knowledge, contributing to the advancement of nanotechnology in India. The FDP was also part of AICTE's broader initiative to support faculty development in emerging areas of technology, ensuring that educators are well-equipped to teach and lead in these fields

Day 1: 19.08.2024

Inauguration and Key Addresses:

The inauguration ceremony was held on August 19, 2024, at 9:00 AM in the Meeting Hall. Distinguished guests and faculty members graced the occasion. The program commenced with traditional rituals of lamp lighting and prayer song. Dr. R. Kannan, Lecturer/Physics, delivered a warm welcome address, setting the tone for the FDP. Dr. S. Senthil Arasu, Principal (i/c), delivered the presidential address, emphasizing the importance of nanotechnology in contemporary research and its potential applications. Thiru. G. Muniasamy, Correspondent, delivered a special address, highlighting the college's commitment to fostering academic excellence and research. Dr. K.R. Muthuswamy, Director, and Dr. K. Kathirvelu, Scientist F from DIA-COE-BU, Bharathiar University, Coimbatore, delivered felicitation and chief guest addresses, respectively. Their insightful remarks provided valuable context and inspiration for the participants. Dr. R. Jothimurugan, Lecturer/Physics, delivered the vote of thanks, expressing gratitude to all the participants and guests for their contribution to the success of the FDP. The program concluded with the national anthem.

FDP Activities

The FDP included a comprehensive curriculum covering various aspects of nanotechnology, including:

- Fundamentals of nanotechnology: Introduction to nanomaterials, properties, and characterization techniques

- Nanomaterials synthesis and fabrication: Top-down and bottom-up approaches, chemical and physical methods
- Nanotechnology applications: Energy, medicine, electronics, and environmental science
- Research methodologies and ethics: Grant writing, intellectual property, and ethical considerations in research

Renowned experts from academia and industry delivered lectures, providing valuable insights and practical knowledge to the participants. Interactive sessions, workshops, and hands-on demonstrations were also organized to enhance learning and engagement. The six-day Faculty Development Programme on "Nanotechnology in Materials Science" was a resounding success. It provided a valuable platform for faculty members to acquire knowledge, skills, and inspiration in the field of nanotechnology. The program contributed to the advancement of nanotechnology research and education in India.

Session 1: 19.08.2024 – 10.00 AM to 12.00PM

Session Title: Advanced Functional Materials for Defence and Environmental Applications

Resource Person: Dr. K. Kadirvelu, Scientist 'F' & Officer-in-Charge, DRDO-BU Center For Life Sciences, Bharathiar University Campus, Coimbatore.

Key Topics Covered:

1. **Introduction to Nanotechnology:**
    - Definition of nanotechnology and its importance in modern science and technology.

- Emphasis on research and technology development at the atomic, molecular, or macromolecular levels, within the length scale of approximately 1 - 100 nanometers.
- The role of nanotechnology in creating structures, devices, and systems with novel properties due to their small size.

2. **Materials of Nanotechnology:**

    - Discussion on various nanostructures such as nanocrystals, quantum dots, nanoparticles, nanowires, and nanotubes.
    - Examples of materials used include insulators, semiconductors, metals, ceramics, and carbon-based structures like fullerenes.

3. **Nanotechnology-Based Products:**

    - Real-world applications of nanotechnology in consumer products like sunscreen (Dermatone SPF 20), vitamin sprays (Nano B-12), and more advanced applications in automobiles and sports equipment.

4. **Environmental Impact and Applications:**

    - Nanotechnology's role in addressing environmental challenges, such as pollution control, water purification, and waste management.
    - The potential of nanomaterials like nanoscale iron for groundwater treatment and nanocatalysts for breaking down pollutants.

5. **Defence Applications:**

    - DRDO's initiatives in utilizing nanotechnology for defense applications, including energy management, stealth materials, high-strength composites, and nanomaterials for sensors and electronic systems.
    - Specific programs like the development of nanomaterials for camouflage, high energy materials, and structural efficiency in defense equipment.

6. **Nanomaterials for Health and Medicine:**

    - The use of nanotechnology in developing advanced sensors, drug delivery systems, and theranostics (therapeutics + diagnostics).
    - Exploration of quantum dots and metal oxide-based gas sensors for medical and environmental monitoring.

7. **R&D and Collaboration:**

    - DRDO's collaboration with academic institutions and industry for advancing nanotechnology research.
    - Establishment of facilities for the synthesis, characterization, and testing of nanomaterials.

This session provided a comprehensive overview of how nanotechnology is shaping the future of materials science, particularly in defense and environmental applications. The insights from Dr. Kadirvelu's presentation underscored the transformative power of nanoscale innovations in solving complex global challenges.

Research Article Review: 12.00 to 1.00 PM

Title of the Research Paper: A review on transfer methods of two-dimensional materials.

Name of the journal: 2D Materials (IOP), Year of Publication: 2024.

Session 2: 19.08.2024 – 2.00 PM to 4.30 PM

Session Title: Transparent Nanoscale Films and Devices

Resource Person: Dr. S. Manivannan, Carbon Nanomaterials Laboratory (CNML), Department of Physics, National Institute of Technology (NIT), Tiruchirappalli, India.

Introduction

The presentation by Dr. S. Manivannan delves into the cutting-edge research and development of transparent nanoscale films and devices, focusing particularly on carbon-based nanomaterials. These materials hold significant promise for the next generation of electronic devices due to their unique properties, including high electrical conductivity, mechanical strength, and flexibility. The work is positioned within the rapidly evolving field of nanotechnology, with implications for a wide range of applications, from flexible displays to gas sensors and beyond.

Overview of Low-Dimensional Carbon Materials

The presentation starts with an introduction to low-dimensional materials, specifically nanocarbon molecules such as carbon dots (CDs), carbon nanotubes (CNTs), and graphene. Each of these materials is noted for its distinct properties that make them suitable for various technological applications: Carbon Dots (CDs) - Known for their tunable emission and high quantum yield, making them ideal for applications in displays and sensors.

Carbon Nanotubes (CNTs): Featuring exceptional mechanical and electrical properties, CNTs are highlighted for their potential in a variety of fields including electronics and energy storage.

Graphene and Its Derivatives: The presentation covers graphene oxide (GO) and reduced graphene oxide (rGO), which are critical for developing transparent and flexible electronic devices.

Synthesis and Characterization Techniques

Dr. Manivannan details the synthesis methods used in the preparation of these nanomaterials. A particular focus is given to the microwave-assisted synthesis of nitrogen-doped carbon dots (N-CDs), which involves a straightforward process using citric acid and ethylene diamine. The presentation also includes advanced characterization techniques such as high-resolution transmission electron microscopy (HRTEM) and selected area electron diffraction (SAED), which confirm the amorphous nature and nanoscale size of the synthesized materials.

Transparent Conducting Films (TCFs)

A significant portion of the presentation is dedicated to the development of transparent conducting films (TCFs) using single-walled carbon nanotubes (SWCNTs). These films exhibit high transmittance and low sheet resistance, making them suitable for use in flexible displays and touchscreens. Dr. Manivannan's team has optimized the spray coating technique to produce uniform TCFs on flexible substrates, achieving impressive optical and electrical properties.

Applications in Flexible and Transparent Devices

The research extends to the application of these nanomaterials in various devices:

Flexible Displays: The SWCNT-based TCFs are demonstrated to be effective for flexible display technologies, combining transparency with high electrical conductivity.

Gas Sensors: The presentation describes the fabrication of paper-based gas sensors using SWCNTs, highlighting their flexibility, disposability, and sensitivity at room temperature.

Heaters and Deicing Applications: CNT-based heaters are shown to be effective in deicing applications, with potential uses in aerospace and automotive industries.

Innovative Nanomaterial Applications

The presentation also explores innovative applications of nanomaterials, such as:

Paper-Based Sensors: These lightweight, flexible, and biodegradable sensors are designed for disposable applications, emphasizing their environmental friendliness and potential in large-scale deployment.

CNT/Polymer Composites: The presentation discusses the development of CNT/polymer composites, which show enhanced mechanical and electrical properties with minimal material loading, making them suitable for energy storage and other advanced applications.

Future Directions and Conclusion

Dr. Manivannan concludes by highlighting the maturity of carbon materials research, yet emphasizes that the field is far from being exhausted. He points to ongoing research in developing new applications for these materials, particularly in flexible and transparent electronics. The presentation also acknowledges collaborations and funding support, underscoring the collaborative nature of this research.

Synthesis of Nanomaterials: 4:30 – 5:30 PM

Title: Synthesis of Nanostructured thin films through electrodeposition route

The demo process of Ni based thin film coatings were clearly explained to the participants and given the following experimental procedure for the synthesis process.

The electroplating citrate bath parameters and their respective conditions of NiMoW coatings were discussed with participants. The two-electrode system has been preferred for NiMoW coatings and the chemicals used to prepare the bath are analytical grade with 99.9% purity. A copper (Cu) sheet of size 3 cm breath and 7 cm in length was used as cathode, and ultrapure stainless steel (SS) of the equivalent was size used as anode for electrodeposition of NiMoW thin films. An epoxy resin-based tape is used as a masking system and it will be pasted over the surface of the cathode (Cu) excepting the area on which the electroplating of NiMoW thin films is required. The pH value of the prepared electroplating solution is altered to 7–8 by adding a few drops of liquid ammonia solution (0.800mM). To maintain the desired pH value between 7 and 8, a buffer like boric and citric acids was added to the bath. Both the electrodes are initially degreased and marginally activated with dilute sulfuric acid and then washed with running triple distilled water before initiating the electrodeposition process.

The Cu surface (cathode) is electroplated by dipping the Cu plate into the prepared ammonium citrate bath, and a desired amount of current (current density of 50 mA/cm^2) is applied for deposition times of 30 min. After the deposition time, the NiMoW coatings were sensibly removed from the bath and washed away with running triple time distilled water. Finally, the synthesized NiMoW thin films were stored in an airlock cover for characterization analysis.

Day: 2

Session 1: 20.08.2024 – 10.00 AM to 12.00PM

Session Title: Nanotechnology in Energy and Environment

Resource Person: Dr. P. Sakthivel, Professor, Department of Nanoscience and Technology, Bharathiar University, Coimbatore.

Key Topics Covered:

1. **Introduction to Nanotechnology:**
    - The presentation began with an introduction to nanotechnology, explaining the nanoscale as a range from approximately 1 nm to 100 nm. Dr. Sakthivel highlighted the historical context, mentioning key figures like Prof. Norio Taniguchi and physicist Prof. Richard Feynman, often considered the father of nanotechnology.
2. **Understanding Nanomaterials:**
    - Dr. Sakthivel compared the macro, micro, and nanoscale dimensions, explaining the unique properties that emerge at the nanoscale, such as enhanced electrical conductivity, reactivity, and different optical properties.
3. **Synthesis of Nanoparticles:**

- Various methods for synthesizing nanoparticles were discussed, including colloidal methods, hydrothermal synthesis, and physical vapor deposition (PVD). He provided a detailed example of the formation of gold nanoparticles using colloidal methods, explaining the chemical reactions and processes involved.

4. **Applications in Energy:**

    - Dr. Sakthivel emphasized the importance of nanotechnology in renewable and non-renewable energy sectors. He discussed solar cells, particularly focusing on organic and inorganic solar cells, and introduced different types of solar cells such as Dye-Sensitized Solar Cells (DSSC), Organic Photovoltaic Cells (OPV), and Quantum Dot Solar Cells.

5. **Environmental Applications:**

    - The presentation also covered the use of nanomaterials for environmental remediation, particularly in the removal of organic pollutants through photocatalytic mechanisms. The example of Sn-doped ZnO nanoparticles for the degradation of methylene blue was highlighted, showing the practical application of nanotechnology in treating environmental contaminants.

6. **Advanced Nanomaterials:**

    - Dr. Sakthivel discussed the latest advancements in nanomaterials, such as quantum dots, fullerenes, and conducting polymers. He explained their potential applications in various technologies, including QLED displays, super hydrophobic coatings, and nano-enabled energy storage systems.

Dr. Sakthivel's presentation was rich in scientific detail, providing participants with a deep understanding of the role of nanotechnology in energy and environmental applications. The session was particularly beneficial for researchers and educators looking to integrate advanced nanomaterials into their work, with practical examples and current research trends highlighted throughout the presentation.

Research Article Review: 12.00 to 1.00 PM – Day 2

Title of the Research Paper: Recent development of coloring alloys.

Name of the journal: 2D Materials (IOP), Year of Publication: 2022.

Session 2: 20.08.2024 – 2.00 PM to 4.30 PM

Session Title: Nanobiotechnology

Resource Person: Dr. P. Premasudha, Assistant Professor, Department of Nanoscience and Technology, Bharathiar University, Coimbatore.

Key Topics Covered:

1. **Introduction to Nanobiotechnology:**

- Dr. Premasudha began by defining nanobiotechnology and its significance in modern science. The introduction emphasized the convergence of nanotechnology and biotechnology, aiming to revolutionize medical diagnostics, drug delivery systems, and biosensors.

2. **Nanomaterials in Biotechnology:**

- She explained the different types of nanomaterials used in biotechnology, including nanoparticles, nanowires, and nanostructured surfaces. The session covered their synthesis, functionalization, and applications in various biological processes.

3. **Applications in Medicine:**

- The presentation highlighted the use of nanoparticles in drug delivery, emphasizing how nanotechnology enables targeted delivery systems that improve the efficacy and reduce the side effects of therapeutic agents. Specific examples included the use of liposomes, dendrimers, and polymeric nanoparticles.

4. **Nanobiosensors:**

- Dr. Premasudha discussed the development and application of nanobiosensors, which are used for detecting specific biological molecules with high sensitivity and specificity. She explained the working principles of various types of nanobiosensors, including optical, electrochemical, and piezoelectric sensors.

5. **Ethical and Safety Considerations:**

- The presentation also addressed the ethical and safety concerns associated with nanobiotechnology. Dr. Premasudha discussed the potential risks of nanomaterials to human health and the environment, stressing the need for rigorous testing and regulation.

Dr. Premasudha's presentation provided a comprehensive overview of nanobiotechnology, bridging the gap between nanotechnology and biological sciences. The session was particularly valuable for participants interested in the medical and biological applications of nanotechnology, offering insights into current research and future directions in the field.

Synthesis of Nanomaterials: 4:30 – 5:30 PM – Day 2

Title: Synthesis of Nanostructured thin films through electrodeposition route – Copper coatings on steel substrate

Day: 3

Session 1: 21.08.2024 – 10.00 AM to 12.00PM

Session Title: The Magnetocaloric Effect: Unveiling the Physics Behind Magnetic Cooling

Resource Person: Dr. A. Murugeswari, Assistant Professor, Anna University, Chennai.

The presentation by Dr. A. Murugeswari is an in-depth exploration of the magnetocaloric effect (MCE) and its applications in magnetic refrigeration.

This technology, which leverages the properties of certain magnetic materials, presents a promising alternative to conventional refrigeration methods, especially in terms of efficiency and environmental impact. The content is positioned within the broader context of materials science, highlighting the intersection of nanotechnology and refrigeration.

1. Overview of Magnetic Refrigeration

Magnetic refrigeration is a cooling technology based on the magnetocaloric effect—a phenomenon where a reversible change in temperature is induced in a magnetic material upon exposure to a changing magnetic field. This effect can be utilized to achieve temperatures ranging from extremely low levels (below 1K) to those typical of household refrigerators, depending on the system design.

2. Comparative Analysis: Magnetic Refrigeration vs. Conventional Systems

Magnetic refrigeration offers several advantages over conventional vapor compression refrigeration (VCR) systems:

- Higher Efficiency: Magnetic refrigeration systems can achieve efficiencies greater than 60%, compared to less than 40% for VCR systems.
- Environmental Benefits: The absence of greenhouse gases like CFCs, HCFCs, and HFCs makes magnetic refrigeration an eco-friendly alternative.
- Compact and Silent Operation: The elimination of compressors leads to lower vibrations and noise, making these systems more compact and quieter.
- Wide Applicability: Magnetic refrigeration has potential applications across various fields, including heat pumps, gas liquefaction, and space industry applications.

3. Historical Context and Development

The magnetocaloric effect was first observed in iron by E. Warburg in 1881. The thermodynamic principles were later independently understood by Debye (1926) and Giaque (1927), who suggested using MCE for low-temperature refrigeration through adiabatic demagnetization. Significant advancements were made in the 1980s and 1990s, particularly with the development of strong magnets like NdFeB and the demonstration of near-room-temperature magnetic refrigeration by Gschneidner and Pecharsky in 1997.

4. **Magnetocaloric Materials**

Key to the success of magnetic refrigeration is the development of suitable magnetocaloric materials. These materials must be ferromagnetic with a Curie temperature close to the operating temperature of the application. The presentation emphasizes the importance of creating magnetic fields ranging from 0.7 to 2 Tesla using available permanent magnets and minimizing thermal losses.

5. **Material Synthesis and Characterization**

The presentation details the synthesis process of magnetocaloric materials, focusing on solid-state reaction methods commonly used for complex oxide materials like Lanthanum Strontium Manganite (LSMO). Advanced characterization techniques, such as PPMS (Physical Property Measurement System) and SQUID magnetometry, are employed to assess the magnetic properties and cooling potential of synthesized materials.

6. **Magnetic Refrigerant Capacity and Relative Cooling Power**

The magnetic refrigerant capacity or relative cooling power (RCP) is a crucial measure in evaluating the efficiency of magnetic refrigeration systems. The presentation illustrates this with specific examples of magnetization isotherms and the calculation of entropy change, highlighting the significance of thermal hysteresis control and material cost considerations, particularly with Fe and Mn-based systems.

7. **Nanomaterials in Magnetic Refrigeration**

. Nanomaterials exhibit unique magnetic properties due to their reduced size and increased surface effects, leading to enhanced magnetocaloric effects compared to bulk materials. The presentation discusses various nanomaterials, such as LSMO nanostructures and Gadolinium-based nanocomposites, which show promise for improving the efficiency and scalability of magnetic refrigeration systems.

8. Conclusion and Future Directions

Dr. Murugeswari concludes by emphasizing the importance of ongoing research in this domain. Future work should focus on:

- Developing new caloric materials with large adiabatic temperature changes and long-term durability.
- Advancing manufacturing processes for caloric solid refrigerants to reduce heat losses.
- Exploring multiple caloric effects and their coupling for enhanced performance.

9. Highlights and Implications

Magnetic cooling represents a groundbreaking technology that addresses key market needs for environmental sustainability, safety, and energy efficiency. The eco-friendly nature of magnetic refrigeration, combined with its wide range of potential applications, underscores its significance in the future landscape of refrigeration technologies.

Research Article Review: 12.00 to 1.00 PM – Day 3

Title of the Research Paper: The effects of Cr addition on microstructure, hardness and tensile properties of as-cast Al–3.8wt.%Cu–(Cr) alloys.

Name of the journal: Journal of Materials Research and Technology (Elsevier): 2020.

Session 2: 21.08.2024 – 2.00 PM to 4.30 PM

Session Title: applications and synthesis of 2D layered materials

Resource Person: Dr. K. Jeganathan, Director, Center for Nanoscience and Technology, Bharathidasan University, Trichy.

The presentation by during the AICTE-sponsored ATAL Faculty Development Programme (FDP) on "Nanotechnology in Materials Science" at Sakthi Polytechnic College focused on the applications and synthesis of 2D layered materials, particularly emphasizing their role in advanced technologies such as photocatalytic water splitting, nanoelectronics, optoelectronics, and electrocatalysis.

Key Highlights of the Presentation:

1. **Introduction to 2D Layered Materials:**
    - 2D materials are emerging due to their unique properties. These materials are synthesized for various functional applications.
    - Notable examples include graphene and transition metal dichalcogenides (TMDCs) like MoS_2 and NbS_2. The talk covered the atomic structure and bonding of these materials, showcasing their strength, flexibility, and electronic properties, which offer advantages over bulk materials.
2. **Applications in Nanoelectronics and Optoelectronics:**
    - The invention of the transistor, which revolutionized the information age, was discussed in the context of material downsizing, tracing the progress from vacuum tubes to today’s nano-scale transistors.
    - The presentation covered Moore’s law and its relevance in modern semiconductor development, highlighting how the transistor has scaled down over time, bringing challenges such as heat dissipation and quantum effects at the nanoscale.
    - 2D materials are promising candidates to address the limits of miniaturization, especially in the development of quantum wells, wires, and dots, which offer controlled electronic properties through quantum confinement.

3. **Synthesis and Characterization Techniques:**

    - Advanced techniques such as Metal-Assisted Chemical Etching (MACE) were discussed for producing silicon nanowires (SiNWs) functionalized with 2D materials like MoS_2 and NbS_2.
    - Detailed morphological and spectroscopic analysis methods, including Raman Spectroscopy and X-ray Photoelectron Spectroscopy (XPS), were presented to characterize these 2D heterostructures.

4. **Photocatalytic Water Splitting:**

    - The potential of using 2D materials for hydrogen generation through photocatalytic and electrocatalytic processes was explored.
    - The water-splitting process, particularly Photoelectrochemical (PEC) Water Splitting, using MoS_2 and NbS_2 as cocatalysts was presented. These materials demonstrate promising performance in hydrogen production due to their excellent electron mobility, stability in acidic environments, and high catalytic activity.
    - Challenges in using silicon for PEC cells, such as bandgap limitations and oxidation, were addressed. However, the combination of SiNWs with 2D materials showed improved photocatalytic efficiency.

5. **Hydrogen as a Future Energy Carrier:**

    - Hydrogen's advantages as a clean fuel for vehicles and industrial applications were emphasized. The presentation also covered the challenges in adopting hydrogen fuel on a large scale, such as cost and competition with fossil fuels.
    - MoS_2/graphene heterostructures were shown to be efficient in electrocatalytic Hydrogen Evolution Reactions (HER) due to their low overpotentials and high stability, presenting a cost-effective alternative to platinum-based catalysts.

6. **Quantum Confinement in Nanostructures:**

    - Quantum confinement in superlattices and nanostructures was explored, highlighting how controlling electron movement at the nanoscale can lead to new device functionalities.

- The significance of this phenomenon in the development of next-generation electronic and optoelectronic devices was discussed, where 2D materials could play a crucial role.

Conclusion:

Dr. Jeganathan's presentation provided an in-depth analysis of the state-of-the-art 2D materials and their vast potential in materials science and nanotechnology. The synthesis techniques, structural characteristics, and their applications in water splitting, nanoelectronics, and clean energy were comprehensively discussed. These materials hold promise for future technologies aimed at sustainability and advanced electronics. The research showcased not only emphasized the technical achievements but also opened up discussions on overcoming the limitations of current technologies with the continued advancement of nanotechnology and materials science.

Synthesis of Nanomaterials: 4:30 – 5:30 PM – Day 3

Title: Synthesis of Nanostructured metal oxides

The demo and practice session of ZnO nanoparticle synthesis were clearly explained to the participants. Molybdenum doped Zinc oxide were successfully synthesized using wet chemical synthesis by varying the concentration of Mo like 0.1%, 0.3%, 0.5% & 0.7% respectively. All the samples were irradiated with the microwave for 15 minutes. The precursors used for this investigation are zinc acetate, molybdenum tri oxide, ethylene glycol and liquid ammonia. Initially, the calculated amount of zinc acetate was dissolved in double distilled water to obtain 0.1molar concentration. In the same way, MoO_3 also dissolved in double distilled water and little amount of ethylene glycol (added by drop by drop) to obtain 0.1 molar concentration. The prepared samples were mixed well, and the solution was stirred vigorously.

The pH value of the solution was adjusted to 8 by adding liquid ammonia until to get precipitated form. After that, the prepared solution was placed in a microwave oven and irradiated for 15 minutes. The obtained product was filtered and washed with double distilled water. Finally, the sample was dried and kept in a furnace at 120℃ for 5 hours.

Day: 4

Session 1: 22.08.2024 – 10.00 AM to 12.00PM

Session Title: Field Emission Scanning Electron Microscopy (FESEM) in nanotechnology and materials science

Resource Person: Dr. P. Balraju, Assistant Professor, Coimbatore Institute of Technology, Coimbatore.

Key Aspects of the Presentation:

1. Historical Context of Nanotechnology:

The lecture began by linking the origins of nanotechnology to ancient artifacts like the Lycurgus Cup from the Roman era, which used nanoparticles of gold and silver to create color-changing effects. This demonstrated that the principles of nanotechnology have been in use for centuries, even though they were not understood at the time.

2. Introduction to Electron Microscopy:

A detailed comparison was made between optical microscopy and electron microscopy, focusing on the resolution limits of light-based microscopy and how electron microscopes overcome these by utilizing shorter wavelengths of electrons. Resolution (resolving power) was discussed in-depth, explaining how electron microscopes achieve nanometer-level precision, necessary for the study of nanomaterials.

3. Types of Electrons and Their Applications:

Dr. Balraju explained the interaction of electrons with matter and the various signals produced, including:

- Secondary Electrons (SE): Used primarily for surface topography.
- Backscattered Electrons (BSE): Highly sensitive to atomic number differences, allowing material composition mapping.
- Characteristic X-rays: Used in Energy Dispersive X-ray Spectroscopy (EDS) to analyze elemental composition.

- The importance of these interactions for obtaining detailed structural, morphological, and chemical information was emphasized.

4. Field Emission Scanning Electron Microscopy (FESEM):

The presentation delved into the workings of the FESEM and its advantages over conventional electron microscopy, particularly in terms of higher resolution, better depth of field, and smaller spot size for imaging. The electron gun in FESEM and the process of image formation were explained. FESEM allows for highly localized analysis, critical for nanotechnology applications, where structures down to the nanometer scale need to be examined.

5. Imaging and Detectors:

Different types of electron detectors were discussed, including Everhart-Thornley detectors for SE and solid-state detectors for BSE. These detectors enable high-resolution imaging and contrast based on atomic numbers. The edge effect and its influence on image quality were also highlighted, showing how different detectors handle surface features and material compositions.

6. Applications in Materials Science:

- FESEM's role in nanomaterial characterization was covered extensively, showcasing its use in fields like:
- Metallurgy: Analyzing grain structures and precipitates.
- Semiconductors: Investigating defects and interface quality at the nano-level.
- Polymers: Examining microstructural morphology.
- Examples of FESEM images from various materials, such as fly ash, cement, and Hg-doped alkali-activated ash cement were presented, demonstrating how FESEM and EDS mapping are used to analyze elemental distribution in complex matrices.

7. Sample Preparation Techniques:

Proper sample preparation for FESEM was highlighted as a critical step to prevent issues like charging, which occurs when non-conductive samples accumulate charge, distorting the image. Solutions such as sputter coating with conductive materials (e.g., gold or carbon) were discussed to mitigate these effects.

8. Advanced Image Processing and 3D Analysis:

The use of image processing software in enhancing SEM images and performing quantitative analysis was introduced. These tools are essential for extracting precise data from the images and improving their interpretability.

9. Conclusion:

Dr. Balraju concluded by reiterating that electron microscopy, particularly FESEM, is an indispensable tool in nanotechnology and materials science. Its ability to provide morphological, structural, and chemical information from the micron to the sub-nanometer scale makes it a versatile and powerful technique. The presentation stressed that a well-prepared specimen and a skilled operator are essential for obtaining high-quality results, reinforcing the need for expertise in handling and interpreting FESEM data.

Research Article Review: 12.00 to 1.00 PM – Day 4

Title of the Research Paper: Comparative Study of Microstructural, Mechanical and Electrochemical Aspects of As-Deposited and Shock Wave Exposed Ni-W Nanostructured Coatings.

Name of the journal: Defence Science Journal (DSJ- DRDO Journal): 2022

Session 2: 22.08.2024 – 2.00 PM to 4.30 PM

Session Title: Effective Routes to Stress Management.

Resource Person: Dr. S. Renukadevi, Professor and Head, Department of Education, NITTTR, Chennai.

Key Components of the Presentation

Definition and Understanding of Stress:

- Stress is described as an individual's physical, mental, emotional, and behavioral response to any demand or threat. It can be both positive (eustress) and negative (distress). Hans Selye's definition of stress is highlighted, emphasizing that stress itself is not inherently bad; it depends on how it is perceived and managed.
- Types of Stress:
  Eustress: A positive form of stress that can enhance performance and efficiency.
  Distress: A negative form of stress that can harm mental and physical health if prolonged.
- Causes **and Sources of Stress:**
  Common stressors for students include academic pressures (studies, examinations, deadlines), time management issues, financial concerns, environmental factors (such as noise and overcrowding), relationship difficulties, and personal problems. Stress is often triggered by perceiving situations as dangerous or difficult and a lack of belief in one's ability to cope with them.
- Sym**ptoms of Stress:**
  Physical Symptoms: Include low energy, headaches, stomach issues, chest pain, insomnia, and nervousness.
  Cognitive Symptoms: Encompass constant worrying, racing thoughts, poor judgment, and inability to focus.
  Emotional Symptoms: Range from frustration, agitation, and moodiness to feelings of being overwhelmed and low self-esteem.
  Behavioral Symptoms: Include procrastination, changes in eating habits, increased substance use, and nervous behaviors.
- **Techniques for Stress Management:**
  A variety of techniques are recommended to manage stress, such as:
  Nutrition and Rest: Proper diet, vitamins, sufficient sleep, and relaxation practices.
  Environmental Adjustments: Creating a pleasant environment, using essential oils,

and engaging in hobbies or laughter.

Mindfulness and Cognitive Approaches: Practices like mindfulness, affirmations, faith, mudras, goal setting, and time management.

Therapies and Exercises: Music therapy, Japanese relaxation methods, Zumba, Yoga Nidra, art therapy, progressive muscle relaxation, and the emotional freedom technique.

Meditation and Hormone Regulation: Gratitude meditation and understanding the role of "happy hormones" (endorphins, serotonin, dopamine, and oxytocin) in stress management.

Summary

Dr. S. Renukadevi's presentation offers a multi-dimensional approach to stress management, targeting the physical, cognitive, emotional, and behavioral aspects of stress. It provides practical strategies that can be applied in educational environments, helping both students and educators understand, manage, and mitigate the effects of stress effectively. The emphasis is on developing resilience and coping skills, promoting a balanced approach to mental and physical well-being.

Synthesis of Nanomaterials: 4:30 – 5:30 PM – Day 4

Title: Synthesis of Nanostructured metal oxides

Day 5: 23.08.2024 – FN - IV

Date of Visit: 23rd August 2024

Event: AICTE Sponsored FDP on Nanotechnology in Materials Science (19th August 2024 - 24th August 2024)

Venue of Visit: DRDO - Industry Academia Excellence Center, Bharathiyar University, Coimbatore

As part of the Faculty Development Program (FDP) on "Nanotechnology in Materials Science" sponsored by the All India Council for Technical Education (AICTE), an industrial visit was organized on 23rd August 2024 to the DRDO - Industry Academia Excellence Center at Bharathiyar University, Coimbatore. The visit provided participants with invaluable exposure to advanced research equipment and processes in the field of nanotechnology and materials science. This report outlines the key experiences and learning outcomes from the visit.

Objectives of the Visit

- To gain hands-on experience with advanced characterization and synthesis tools used in materials science.
- To enhance understanding of the practical applications of nanotechnology in defense and sensor-related fields.
- To foster collaboration between academia and industry in the domain of nanotechnology.

Overview of Facilities and Demonstrations

During the visit, participants had the opportunity to observe and interact with various high-end research facilities, including:

1. **X-Ray Diffraction (XRD) Facility**
   The participants were introduced to the working principles and applications of X-ray diffraction in analyzing crystal structures of materials. The demonstration highlighted how XRD can be used for determining phase purity, crystallinity, and lattice parameters of nanomaterials.

2. **Scanning Electron Microscope (SEM)**
   The SEM facility provided participants with a detailed view of the surface morphology and microstructures of synthesized materials. Participants gained insights into how SEM can be applied to nanomaterial research, especially for imaging at nanoscale resolutions.

3. **Electrochemical Work Station**
   The visit to the electrochemical work station included a demonstration of techniques such

as cyclic voltammetry and electrochemical impedance spectroscopy. These techniques are critical for evaluating the performance of energy storage devices, sensors, and catalysts.

4. **Materials Synthesis Lab**

   In the materials synthesis lab, participants observed the synthesis of nanomaterials using different chemical and physical methods. The hands-on experience provided a deeper understanding of the parameters that influence material properties such as particle size, morphology, and composition.

5. **Ball Milling Unit**

   The ball milling demonstration introduced participants to a powerful technique for mechanical alloying and nanoparticle synthesis. The process is particularly useful for creating materials with unique structural and mechanical properties.

6. **Sensor Lab**

   The sensor lab showcased the development and testing of various sensors used in defense and environmental monitoring. Participants were introduced to the role of nanomaterials in enhancing sensor sensitivity and selectivity.

Conclusion:

The industrial visit to the DRDO - Industry Academia Excellence Center provided a valuable, hands-on learning experience for all participants. By observing and interacting with advanced instrumentation in nanotechnology, the participants gained practical knowledge that complements the theoretical foundation provided in the FDP. The exposure to XRD, SEM, electrochemical workstations, and other state-of-the-art facilities enabled participants to better appreciate the complexity and importance of material characterization and synthesis techniques, crucial for research and innovation in the field of nanotechnology.

This visit not only enhanced the participants' technical skills but also fostered potential future collaborations between academia and industry, promoting advancements in materials science research.

Session 2: 23.08.2024 - Day 5

Session Title: Energy Storage Materials

Resource Person: Dr. S. Karuppuchamy, Professor and Head, Department of Energy Science. Alagappa University, Karaikudi.

The FDP underscored the importance of nanomaterials in addressing some of the most pressing global challenges, such as energy scarcity, environmental degradation, and healthcare needs. The program highlighted how the manipulation of materials at the nanoscale can lead to innovative solutions that are not feasible with conventional materials.

Renewable Energy and Nanotechnology

A significant portion of the FDP was dedicated to exploring the role of nanotechnology in renewable energy. With the global push towards sustainable energy sources, nanomaterials are seen as key enablers in the development of next-generation solar cells, batteries, and hydrogen storage systems. The FDP sessions detailed the synthesis and characterization of nanomaterials for energy applications, including Dye-Sensitized Solar Cells (DSSCs) and Perovskite Solar Cells.

Dye-Sensitized Solar Cells (DSSCs): The FDP covered the fundamentals of DSSCs, focusing on the electrodeposition of semiconductor oxides and the use of core/shell structured materials to enhance efficiency. The program emphasized the potential of DSSCs for low-cost, flexible solar cells suitable for rural and tribal applications.

Perovskite Solar Cells: Participants were introduced to the latest advancements in perovskite solar cells, which are known for their high efficiency and low production costs. The discussions included the challenges of stability and the need to develop non-toxic alternatives to lead-based perovskites.

Environmental Applications of Nanomaterials

Nanotechnology's role in environmental protection was another key theme of the FDP. The sessions highlighted the application of nanomaterials in water purification, air filtration,

and soil remediation. The ability of nanomaterials to interact with pollutants at the molecular level allows for the development of more effective and sustainable environmental technologies.

Bio-Nanomaterials

The FDP also covered the emerging field of bio-nanomaterials, which integrates biological molecules with nanotechnology to create materials with novel functionalities. These materials have potential applications in targeted drug delivery, tissue engineering, and biosensing.

Conclusion

The AICTE-sponsored ATAL FDP on Nanotechnology in Materials Science at Sakthi Polytechnic College was a highly successful event, providing participants with a deep understanding of the potential and challenges of nanotechnology. The program fostered collaboration between academia and industry, paving the way for future research and innovation in the field of nanomaterials.

Synthesis of Nanomaterials: 4:30 – 5:30 PM – Day 4

Title: Surface roughness analysis using laser and MATLAB software

Day 6

Session 1: 24.08.2024 – 10.00 AM to 12.00PM

Session Title: Nanomaterials for industrial instrumentation.

Resource Person: Dr. M. Devendran, : Application Specialist, PerkinElmer India Pvt Ltd, Chennai.

Key Highlights:

1. Material Characterization Overview:

Dr. Devendran outlined key material characterization techniques used in research and industrial applications. Techniques like FT-NIR/FT-IR, UV-VIS Spectroscopy, and fluorescence spectrometry were introduced, which are essential for analyzing the optical, chemical, and structural properties of nanomaterials and advanced materials.

2. Spectroscopy Fundamentals:

The presentation defined spectroscopy as the interaction of electromagnetic radiation with matter and explained how different frequencies of light interact uniquely with various materials. Emphasis was placed on UV-Vis spectroscopy, which analyzes the absorption of ultraviolet and visible light by materials, providing insights into molecular structure, chromophores, and electronic transitions.

3. Advanced Instrumentation:

Dr. Devendran highlighted the use of PerkinElmer Lambda series UV-Vis-NIR spectrometers for high-performance material analysis. These instruments are capable of measuring absorbance, transmittance, and reflectance across a wide wavelength range (UV-Vis-NIR), enabling detailed analysis of thin films, polymers, coatings, and glasses. The presentation also discussed IR microscopy and imaging techniques, which combine infrared spectroscopy with microscopy for detailed spatial analysis of micro-scale materials. This is particularly useful for investigating microplastics, contaminants, and surface properties of nanomaterials.

4. UV-Vis and IR Spectroscopy Applications:

The utility of these techniques in industries such as semiconductors, automotive, and food safety was covered. UV-Vis-NIR spectrometers, for instance, are used in optical coatings, color analysis, and film thickness measurements, making them indispensable in the study of advanced materials like thin films, coatings, and nanostructured devices. FT-IR spectroscopy was highlighted for identifying functional groups and molecular structures, crucial for polymer analysis and studying molecular vibrations in materials.

5. Factors Affecting Spectroscopic Measurements:

Dr. Devendran elaborated on factors influencing spectroscopic measurements, including solvent effects, temperature, pH, and sample morphology. These can impact the absorbance, fluorescence, and scattering of light, which must be accounted for to obtain accurate results. Beer-Lambert Law was discussed in detail, emphasizing how absorbance is related to concentration and path length, forming the basis of quantitative analysis in UV-Vis spectroscopy.

6. Material Applications:

The presentation covered diverse material applications including polymer science, biological systems, environmental analysis, and industrial quality control. For example, band gap measurement using UV-Vis spectrometers was explored, which is critical for evaluating semiconductors and photovoltaic materials.

7. Thermal Analysis Techniques:

Dr. Devendran introduced thermal analysis techniques, including Thermogravimetric Analysis (TGA) and Differential Scanning Calorimetry (DSC). These techniques measure mass changes and heat flows in materials as they are heated or cooled, providing insights into thermal stability, composition, and decomposition behavior. These methods are widely used in the polymer, pharmaceutical, and automotive industries.

8. Hyphenated Techniques for Advanced Analysis:

The concept of hyphenated techniques like TG-IR and TG-GC/MS (Thermogravimetric Analysis coupled with Infrared Spectroscopy or Gas Chromatography/Mass Spectrometry) was discussed. These techniques allow simultaneous analysis of thermal and chemical changes, useful for analyzing complex materials, polymers, and contaminated soils.

Conclusion:

Dr. Devendran's presentation provided an in-depth exploration of modern spectroscopic and thermal analysis techniques and their application in materials science, particularly for nanotechnology. The emphasis on PerkinElmer instruments and their role in advanced material characterization underscored the importance of accurate, high-resolution analytical techniques in research and industrial applications. These methods enable a detailed understanding of material properties, crucial for the development and optimization of nanomaterials and advanced functional materials.

Day 6 – 12.00 PM to 1.00 PM

Article Summary Session: Samples attached

Day 6 –2.00 PM to 4.00 PM

MCQ & Reflection Journal – Samples attached

SAKTHI POLYTECHNIC COLLEGE

SAKTHI NAGAR – 638 315

AICTE Training and Learning (ATAL) Academy

Sponsored

Six Day Faculty Development Programme (FDP)

on

"Nanotechnology in Materials Science"

(Bridging Education with Research and Applications)

Valedictory Function

Date: 24.08.2024, Saturday @ 3:30 PM

Venue: CAD Lab
Dept. of Mech. Engg.

: Prayer Song

Welcome Address
and FDP Report: Dr. R. Kannan
Lecturer/Physics

Presidential Address: Dr. S. Senthil Arasu
Principal (i/c)

Special Address: Thiru. G. Muniasamy
Correspondent

Felicitation Address: Dr. K.R. Muthuswamy
Director

Feedback by Participants

Vote of Thanks: Dr. R. Jothimurugan
Lecturer/Physics

: National Anthem

All are welcome

Day 6 - Valedictory Function – 4.00 to 5.00 PM

The valedictory function of the FDP was held on August 24, 2024, at 3:30 PM in the CAD Lab of the Department of Mechanical Engineering. The event was graced by esteemed dignitaries from the academic and administrative spheres of the institution.

Key Speakers and Their Contributions

- Dr. R. Kannan: The FDP coordinator and lecturer in Physics delivered the welcome address and presented a comprehensive report on the program's activities and outcomes.
- Dr. S. Senthil Arasu: The Principal (i/c) of Sakthi Polytechnic College delivered the presidential address, emphasizing the importance of nanotechnology in contemporary engineering and research.
- Thiru. G. Muniasamy: The Correspondent of the college shared his insights on the role of educational institutions in fostering innovation and technological advancements.
- Dr. K.R. Muthuswamy: The Director of the institution delivered the felicitation address, acknowledging the efforts of the participants and organizers.
- Dr. R. Jothimurugan: The lecturer in Physics delivered the vote of thanks, expressing gratitude to all the participants, speakers, and organizers for their contributions to the FDP's success.

Highlights of the FDP

- Comprehensive Curriculum: The FDP covered a wide range of topics related to nanotechnology, including materials synthesis, characterization, properties, and applications.
- Expert Lectures: Renowned experts from academia and industry delivered insightful lectures, sharing their knowledge and experiences in the field of nanotechnology.
- Hands-on Workshops: Participants had the opportunity to engage in practical workshops, gaining hands-on experience in nanotechnology techniques and experiments.
- Research Presentations: Participants presented their research work, fostering knowledge sharing and collaboration among the academic community.

Conclusion

The six-day FDP on "Nanotechnology in Materials Science" was a resounding success, providing valuable insights and training to the faculty members of Sakthi Polytechnic College. The program effectively bridged the gap between education, research, and applications in the field of nanotechnology, equipping the participants with the necessary skills to contribute to advancements in this emerging area. The FDP served as a valuable platform for knowledge exchange, collaboration, and professional development.

AICTE ATAL Sponsored FDPon "Nanotechnology in Materials Science"

Aug 19-24, 2024.

Participant Attendance Register

S.No	Name of the Participant	Institute Name	19/8 FN	19/8 AN	20/8 FN	20/8 AN	21/8 FN	21/8 AN	22/8 FN	22/8 AN	23/8 FN	23/8 AN	24/8 FN	24/8 AN
1	Mr. M. Vadivel	Sri Ramakrishna Mission VidyalayaPolytechnic College												
2	Mr. V. Arivazhagan	Annai JKK SampooraniAmmalPolytechnic College	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB
3	Mr. A. K. Nachimuthu	Christ The King Polytechnic College												
4	Mrs. M. Revathi	Excel Engineering College												
5	Dr. A.Sivaprakasam	Erode Sengunthar Engineering College												
6	Dr. S.Arulmozhi	Erode Sengunthar Engineering College												
7	Mr. C. Ravi	ImayamCollege of Engineering												
8	Dr.ManikandanMurugesan	K.Ramakrishnan College of Technology												
9	Dr. K.V.Gunavathy	Kongu Engineering College												
10	Dr. C. Rngasami	Kongu Engineering College												

S.No	Name of the Participant	Institute Name	19/8 FN	19/8 AN	20/8 FN	20/8 AN	21/8 FN	21/8 AN	22/8 FN	22/8 AN	23/8 FN	23/8 AN	24/8 FN	24/8 AN
11	Dr.AnandSiddeswaran	KSR Institute for Engineering and Technology												
12	Dr.S. Agiladevi	KSR Institute for Engineering and Technology												
13	Dr. S. Inbakumar	Kumaraguru College of Technology												
14	Miss. V. Divya	Kumaraguru College of Technology												
15	Miss. P. K. Dharani Priya	Kumaraguru College of Technology												
16	Dr. R Sengodan	Kumaraguru College of Technology												
17	Mrs. J. Vidhya	M. Kumarasamy College of Engineering												
18	Dr.C. Thangamani	M.Kumarasamy College of Engineering												
19	Miss. A.Shalini	Nandha Arts and Science College												
20	Miss. R.S.Deepikambikai	Nandha Arts and Science College												
21	Miss. S. Santhiya	Nandha Arts and Science College												
22	Miss. R.Subhashini	Nandha Arts and Science College												
23	Miss. L. Ranjithasmilin	Nandha Arts and Science College												
24	Mr. P.Udhayanandhan	Nandha Arts and Science College												

S.No	Name of the Participant	Institute Name	19/8 FN	19/8 AN	20/8 FN	20/8 AN	21/8 FN	21/8 AN	22/8 FN	22/8 AN	23/8 FN	23/8 AN	24/8 FN	24/8 AN
25	Mr. S. Saravanan	NandhaPolytechnic College												
26	Mr. G. Munusamy	NandhaPolytechnic College												
27	Dr.Kalaiselvi	Navarasam Arts and Science College for Women												
28	Miss. B. Blessymol	NavarasamArts and Science College for Women												
29	Miss. P.Yasotha	Navarasam Arts and Science College for Women												
30	Miss Ponsofiya	Navarasam Arts and Science College for Women												
31	Dr.RajnishKumar Sharma	Siddhartha Institute of Engineering and Technology												
32	Dr.M. VeeraGajendraBabu.	SankarPolytechnic College												
33	Mr. N. AthisivaSelvam	Sankar Polytechnic College												
34	Mr. B. Selvasundaram	Sankar Polytechnic College												
35	Dr.P. Sivasubramanian	PTR College of Engineering and Technology												
36	Mr. C. Vijayaraj	Sakthi Polytechnic College												
37	Mr. P. Govindarasu	Sakthi Polytechnic College												
38	Mr. M. Vikram	Sakthi Polytechnic College												

S.No	Name of the Participant	Institute Name	19/8 FN	19/8 AN	20/8 FN	20/8 AN	21/8 FN	21/8 AN	22/8 FN	22/8 AN	23/8 FN	23/8 AN	24/8 FN	24/8 AN
39	Mr. J.Yuvaraja	Sakthi Polytechnic College												
40	Dr. R. Shanmugam	Sakthi Polytechnic College												
41	Mr. T. Velmurugan	Sakthi Polytechnic College												
42	Mr. K.Saravanan	Sakthi Polytechnic College												
43	Mr. P. Kamalesan	Sakthi Polytechnic College												
44	Mrs. A. YogamalarCarunyam	Sakthi Polytechnic College												
45	Mr. P. Panneerselvam	Sakthi Polytechnic College												
46	Mr. V. Naveenkumar	Sakthi Polytechnic College												

Annexure-IV

Reflective Journal

Personal Information

i. Name : Dr.S.Arulmozhi

ii. Designation : Associate Professor

iii. Institution/Organization : Erode Sengunthar Engineering College,
Thudupathi - 638057

iv. FDP Title : Nanotechnology in Material Science

v. Date of Reflection : 24.08.2024

Key Learnings (Outcomes)

Learning 1: Advanced materials for protective and sensing application

- Identification and development of materials with superior mechanical strength, impact resistance, and thermal stability.
- Creation of lightweight materials that offer high levels of protection against physical threats, such as ballistic impacts or blasts, without significantly adding to the weight.
- Advanced coatings or bulk materials with exceptional resistance to corrosion, wear, and oxidation.
- Development of textiles with integrated sensing capabilities that can monitor physiological parameters (e.g., temperature, heart rate) while providing protection against environmental hazards like fire, chemicals, or extreme temperatures

Learning 2: Nanobiotechnology

- Nanoparticles to deliver drugs directly to diseased cells, minimizing side effects and improving treatment efficacy.
- Nanobiotechnology contributes to tissue engineering and regenerative medicine by developing nanomaterials that mimic the extracellular matrix, supporting cell growth and tissue repair.

Learning 3: Effective Routes for Stress Management

- Effective stress management techniques can significantly reduce symptoms of anxiety and depression by addressing the root causes of stress and teaching coping mechanisms.
- Chronic stress is linked to a range of health issues, including heart disease, hypertension, and weakened immune function. Effective stress management can lower the risk of these conditions by reducing physiological stress responses.

Key Lessons (Concepts/Ideas) for Implementation

Lesson 1: Advanced materials for protective and sensing application

- Materials with structures at the nanoscale exhibit unique properties such as increased strength, enhanced conductivity, and greater surface area.
- Combining nanoparticles with polymers or metals to create materials with superior mechanical properties and corrosion resistance, ideal for protective coatings.

Lesson 2: Nanobiotechnology

- Engineering nanoparticles and other nanomaterials to encapsulate drugs, protect them from degradation, and release them at specific sites within the body.
- Developing targeted drug delivery systems that can cross biological barriers like the blood-brain barrier, enhancing the treatment of diseases such as brain cancer or neurodegenerative disorders.

Lesson 3: Effective Routes for Stress Management

- Regular physical activity is a powerful tool for managing stress. Exercise releases endorphins, improves mood, and helps reduce the physiological impact of stress.
- Meditation practices help calm the mind and reduce stress by promoting relaxation and focused awareness.

Implementation Plan

Lesson 1: Advanced materials for protective and sensing application

Description:
By integrating nanomaterials into environmental engineering, we can enhance the efficiency, sensitivity, and sustainability of technologies used in protecting and monitoring the environment.

Action Steps:

- Design and Synthesis of nanomaterials.
- Prototype Development
- Functional Testing

Timeline: 6 months

Lesson 2: Nanobiotechnology

Description:
Implementing a nanobiotechnology project involves a well-structured plan that addresses the scientific, technical, regulatory, and practical aspects of the technology.

Action Steps:

- Material Selection
- Prototype Development
- In Vitro Testing
- Optimization
- In Vivo Testing (if applicable)

Timeline: 1 Year

Lesson 3: Effective Routes for Stress Management

Description:
Implementing effective stress management strategies involves a structured approach that includes planning, execution, evaluation, and refinement.

Action Steps:

- Develop Sustainability Plan
- Expand Reach
- Build Partnerships
- Share Best Practices
- Address Emerging Needs and Trends
- Conduct Long-Term Assessments

Timeline: Immediate

Overall Reflection:
The Faculty Development on “Nanotechnology in Materials Science” provide an insight about the synthesis and characterization of nanomaterials. As a Environmental Engineering faculty In future I got idea to implement nanotechnology in the protecting the environment by reducing the pollution load. I assure to provide ideas to the students to do research with nanotechnology.

Annexure-III

Article Summary

Article Title: Comparative Study of Microstructural, Mechanical and Electrochemical Aspects of As-Deposited and Shock Wave Exposed Ni-W Nanostructured Coatings

Journal Source: Defence Science Journal, Vol. 72, No. 4, July 2022, pp. 600-608, 2022.

FDP Theme: Nano technology in Material Science

Team Information

Team Name: Team 1

Team Members:

Dr.S.Agiladevi

Dr.S.Arulmozhi

Dr.K.V.Gunavathy

Dr.A.Sivaprakasam

Dr.C.Rangasami

Ms.M.Revathi

Summary Key Principles/Practices from the Article (3-4 bullets for the Team)

Principle 1 : Importance of Nickel Titanium nano coatings

Nickel-based alloys exhibit high temperature and pressure resistance and resistant to a few chemical components. They have high corrosion resistance and wear resistance. They are commonly used in industrial applications. Aluminum, titanium, niobium, silicon, molybdenum, cobalt, tungsten are commonly alloyed with Nickel to have improved mechanical properties

Principle 2 : Electrodeposition

A copper plate was used as the cathode and stainless-steel plate was used as the anode. A platinum electrode and Saturated Calomel Electrode (SCE) were used as the auxiliary and reference electrodes. The current density of the electrolyte was maintained at 1 A/dm^2

Principle 3 : Shock Wave tube to induce mechanical surface treatment

The total length of the shock tube is separated into two parts by a diaphragm with a driver section and a driven section. A high pressure pressure source with suitable

open/closed valves supplies air to the driver section gradually, with all the connecting flanges and diaphragm airtight. The driven section may be connected to a vacuum pump to maintain the required vacuum pressure. The specimen of investigation is fixed at the closed end of the driven section within the shock tube in such a way that the shock wave traversing through the shock tube will impinge on it.

Principle 4 : Characterization analysis using XRD, SEM , EDS, wear and corrosion analysis.

With an increase in the cycle of shock waves, the crystallite size is increased further. The increase in crystallite size contributed to reduced dislocation density and strain. under higher pressure exposure conditions with an increased Mach number, the morphology changed from upright plates into rod-shaped structures. pressure shock waves is observed to be negligible which in turn shows the higher degree of adherence for the deposited coatings with the substrate. The hardness value increased with the shock wave exposure. The wear rate is inversely proportional to hardness. Upon shock wave exposure to the NiW alloy in various pressure conditions, their mechanical properties like hardness have been increased due to the agglomeration of NiW particles which intern enhances the corrosion resistance value without any appreciable compositional changes.

Application of Principles/Practices in your Function

Team Member: Dr.S.Agiladevi

The manuscript describes about the Field Emission Scanning Electron Microscopy (FESEM) helps analyze the surface morphology, showing that the shock wave exposure results in a defect-free surface. Surface smoothness and defect minimization are key to enhancing corrosion resistance and wear resistance. The use of Electrochemical Impedance Spectroscopy (EIS) to assess corrosion resistance indicates that shock wave treatment significantly improves the coating's ability to withstand corrosive environments. The enhancement is more pronounced at higher Mach numbers, suggesting that shock waves induce beneficial changes at the microstructural level.

Team Member: Dr.S.Arulmozhi

The manuscript describes the following material science and engineering principles in their research work. The deposition of NiW coatings via electroplating involves principles of electrochemistry, where an electric current reduces metal cations in a solution to form a coherent metal coating on the substrate. X-ray diffraction (XRD) analysis reveals the stability of the cubic phase in the coatings before and after shock wave exposure, indicating that the shock waves do not alter the fundamental crystallographic structure. This is essential in understanding the material's performance under extreme conditions. The reported crystallite size (5-17 nm) shows the material's nanostructured nature, which is critical for enhancing mechanical properties like hardness and corrosion resistance.

Team Member: Dr.K.V.Gunavathy

The manuscript briefs about increase in the wear resistance and corrosion resistance of NiW nano coatings due to shock wave modified surface fabricated at two different temperatures by electrodeposition technique. The presence of crystallite NiW was confimed by comparing the XRD peaks with the standard. The surface morphology showed rod like structures for the shock wave exposed film deposited at 75°C. EDS analysis show very less variation in the elemental composition. The same sample showed a higher wear resistance and high hardness. Tafel plot and Nyquist polt shows an increase in corrosion resistance for the film coated at high temperature and processed with higher Mach shock waves. The paper gives me an insight into the formulation of problem and how to proceed with the experimental work. I had learnt how to write a paper in a structured way, how to interpret the results and write conclusion. This paper will certainly improve the way in which I formulate a manuscript.

Team Member: Dr.A.Sivaprakasam

The study investigates the impact of shock wave exposure on electroplated NiW (Nickel-Tungsten) coatings. NiW coatings were deposited at two bath temperatures (35 °C and 75 °C) with a constant current density of 1 A/dm^2. The Shock Wave Coatings were exposed to shock waves with Mach numbers of 1.34 and 2.33 using a shock wave tube. Coatings were analyzed using XRD, FESEM, EDS, Vickers micro indenter, Pin-on-disc, and EIS to assess structural and mechanical properties. Structural Findings, XRD results revealed a stable cubic (Face-Centered Cubic) phase in both as-deposited and shock wave-exposed coatings, with crystallite sizes ranging from 5 nm to 17 nm. EDS analysis showed similar elemental composition in both as-deposited and shock wave-exposed coatings, indicating compositional stability. FESEM images showed that shock wave exposure resulted in defect-free thin films. Corrosion resistance improved significantly with shock wave exposure ten times greater for high Mach number (pressure ~63 bar) and three times greater for low Mach number (pressure ~13 bar) compared to as-deposited films. The wear rate of high-temperature deposited NiW samples was lower, indicating improved hardness. Shock wave exposure enhances the structural, morphological, and corrosion properties of NiW coatings, making them more stable and durable.

Team Member: Dr.C.Rangasami

The study examines how shock wave exposure affects electroplated NiW (Nickel-Tungsten) coatings. NiW coatings were deposited at two different bath temperatures (35 °C and 75 °C) using a constant current density of 1 A/dm^2. These coatings were then subjected to shock waves with Mach numbers of 1.34 and 2.33 in a shock wave tube. To evaluate the structural and mechanical properties, various analyses were conducted including XRD, FESEM, EDS, Vickers micro indentation, Pin-on-disc, and EIS. XRD analysis indicated that both the as-deposited and shock wave-exposed coatings

maintained a stable cubic (Face-Centered Cubic) phase, with crystallite sizes ranging between 5 nm and 17 nm. EDS analysis showed that the elemental composition remained consistent between as-deposited and shock wave-exposed coatings, reflecting compositional stability. FESEM images revealed that the shock wave exposure did not induce defects in the thin films. Additionally, corrosion resistance improved significantly with shock wave exposure tenfold for coatings subjected to high Mach number (pressure ~63 bar) and threefold for those exposed to low Mach number (pressure ~13 bar) compared to as-deposited films. The wear rate for NiW samples deposited at high temperatures was lower, indicating enhanced hardness. Overall, shock wave exposure enhances the structural integrity, morphology, and corrosion resistance of NiW coatings, contributing to their increased stability and durability.

Team Member: Ms.M.Revathi

The study investigates the effects of shock wave exposure on electroplated NiW (Nickel-Tungsten) coatings. NiW coatings were deposited at two different bath temperatures (35 °C and 75 °C) with a constant current density of 1 A/dm^2 and then exposed to shock waves with Mach numbers of 1.34 and 2.33 using a shock wave tube. To assess the structural and mechanical properties of the coatings, a range of analyses were performed, including XRD, FESEM, EDS, Vickers micro indentation, Pin-on-disc, and EIS. XRD analysis showed that both the as-deposited and shock wave-exposed coatings retained a stable cubic (Face-Centered Cubic) phase, with crystallite sizes ranging from 5 nm to 17 nm. EDS analysis confirmed that the elemental composition remained consistent across both types of coatings, indicating compositional stability. FESEM images demonstrated that shock wave exposure did not introduce defects into the thin films. Furthermore, corrosion resistance was significantly enhanced by shock wave exposure tenfold for coatings subjected to high Mach number (pressure ~63 bar) and threefold for those exposed to low Mach number (pressure ~13 bar) compared to as-deposited films. The wear rate was lower for NiW samples deposited at higher temperatures, suggesting improved hardness. In summary, shock wave exposure improves the structural integrity, morphology, and corrosion resistance of NiW coatings, resulting in increased stability and durability.

Key Takeaways from the Article

- The structure of an article along with abstract and key word selection
- Fabricating films using electro deposition technique
- Interpretation of results from different analytical techniques
- Presentation of tables and graphs.

Conclusion

After reading the paper, we were able to understand on how to formulate a hypothesis, identify a problem and how to do literature survey on a narrow topic. It gave

us an idea on how to interpret results from different characterisation techniques. It introduced us to yet another low cost deposition technique that can be adopted easily without much constraint even in a very small scale laboratory.

IV Report

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Introduction and Objective

Title: Industrial Visit Report: DRDO Industry Academia Excellence Centre

Date: 23.08.2024

Objective: To gain hands-on experience and insight into the synthesis and characterization of nanomaterials and their applications in various fields.

Introduction:

The DRDO is a premier agency under the Ministry of Defence, India, charged with the development of defence technologies across various domains, including aeronautics, armaments, electronics, and materials science. The organization plays a critical role in ensuring the nation's defence capabilities, working at the cutting edge of technology to deliver advanced solutions that meet the stringent requirements of the Indian Armed Forces.

The industry-Academia Excellence Centre is a pivotal initiative by DRDO to foster collaboration between academic institutions and the defence sector. It aims to leverage the research expertise of academia and the practical experience of industry to accelerate innovation and address the technological challenges faced by the defence sector.

During the visit, participants were given the opportunity to interact with DRDO scientists and engineers, observe state-of-the-art research facilities, and gain insights into the current projects and technologies being developed at the centre. The visit provided a deeper understanding of the applications of scientific research in national defence and highlighted the importance of industry-academia partnerships in driving technological advancements.

This report details the key takeaways from the visit, including the insights gained, the technologies observed, and the potential opportunities for future collaboration between our institution and the DRDO.

Observations and Learnings

Overview of DRDO's nanomaterials research and development

The objective of DRDO's nanomaterials research and development is to harness the unique properties of nanomaterials to create advanced materials and technologies that enhance

the performance, durability, and effectiveness of defense systems. During our visit, we learned how DRDO is focusing on the development of nanomaterials for applications such as lightweight armor, high-strength composites, and enhanced thermal and electromagnetic shielding. The research aims to push the boundaries of material science, enabling innovations that can provide strategic advantages in defense. Through this exploration, we gained valuable insights into the potential of nanotechnology to revolutionize defense capabilities and the critical role of interdisciplinary research in achieving these advancements.

Synthesis techniques: sol-gel, hydrothermal, and ball milling

The objective of exploring synthesis techniques such as sol-gel, hydrothermal, and ball milling is to understand the various methods available for producing nanomaterials with tailored properties for specific applications. Each technique offers distinct advantages in terms of particle size control, material purity, and structural uniformity. During our learning, we delved into how the sol-gel process allows for precise control over the chemical composition and homogeneity of nanomaterials, while the hydrothermal method facilitates the growth of high-quality crystals under controlled conditions. Ball milling, on the other hand, is a mechanical process that enables the production of nanomaterials with varying degrees of crystallinity and particle size. Through these synthesis techniques, we gained a comprehensive understanding of how different methods can be employed to create materials with desired properties for advanced technological applications.

Characterization techniques: SEM, TEM, XRD, and FTIR

The objective of studying characterization techniques such as Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), X-ray Diffraction (XRD), and Fourier-Transform Infrared Spectroscopy (FTIR) is to gain a deep understanding of how to analyze and interpret the structural, morphological, and compositional properties of nanomaterials.

During our learning, we explored how SEM provides detailed images of surface topography and composition at a micro to nanometer scale, while TEM offers insights into the internal structure and crystallography at an atomic level. XRD was studied for its ability to identify crystalline phases and determine the crystallographic structure, essential for understanding material properties. FTIR was discussed for its application in identifying chemical bonds and functional groups within a material, providing information on the material's molecular composition. Through these techniques, we acquired the skills to effectively characterize nanomaterials, which is crucial for tailoring their properties for specific applications in research and industry.

Applications of nanomaterials: energy storage, biomedical, and aerospace

The objective of studying the applications of nanomaterials in energy storage, biomedical, and aerospace fields is to understand how the unique properties of nanomaterials can be harnessed to innovate and improve technologies in these critical sectors.

During our learning, we explored how nanomaterials are revolutionizing energy storage systems by enhancing the efficiency and capacity of batteries and supercapacitors, leading to longer-lasting and faster-charging energy solutions. In the biomedical field, we examined how nanomaterials are being used to develop targeted drug delivery systems, advanced imaging techniques, and new diagnostic tools, which are improving the effectiveness of treatments and patient outcomes. In aerospace, we learned about the role of nanomaterials in creating lightweight, durable, and heat-resistant materials, which are crucial for improving the performance and safety of aircraft and spacecraft. This understanding highlights the interdisciplinary nature of nanotechnology and its potential to drive innovation across various industries.

Interaction with researchers and scientists: insights into ongoing projects and future directions.

The objective of interacting with researchers and scientists was to gain firsthand insights into ongoing projects at the forefront of nanomaterials research and to understand the future directions and emerging trends in this rapidly evolving field.

Through these interactions, we learned about the current challenges and breakthroughs in nanomaterials research, including cutting-edge projects focused on advanced synthesis techniques, novel applications, and scaling up production for industrial use. The discussions provided valuable perspectives on how research is translating into real-world applications, and we gained a deeper appreciation for the collaborative efforts required to drive innovation. Additionally, we were able to explore potential future directions, such as the integration of nanomaterials into next-generation technologies, the importance of sustainability in research, and the growing emphasis on interdisciplinary approaches. This experience underscored the importance of ongoing research and collaboration in pushing the boundaries of what is possible with nanomaterials.

Conclusion and Recommendations

Summary of key takeaways from the visit

The visit to the DRDO Organisation Industry Academia Excellence Centre provided an in-depth understanding of the cutting-edge research and development activities in the field of nanomaterials. We gained valuable insights into the various synthesis and characterization techniques, as well as the diverse applications of nanomaterials in energy storage, biomedical, and aerospace sectors. The interactions with leading researchers and scientists offered a unique perspective on ongoing projects, challenges, and future trends in nanotechnology. The experience reinforced the importance of interdisciplinary collaboration and innovation in advancing the field of nanotechnology.

Implications for teaching and research in nanotechnology

The knowledge acquired during the visit will significantly enhance our teaching and research capabilities in nanotechnology. The exposure to advanced synthesis techniques like sol-gel, hydrothermal, and ball milling, along with characterization tools such as SEM, TEM, XRD, and FTIR, will enable us to incorporate more practical and cutting-edge examples into our curriculum. Furthermore, understanding the real-world applications of nanomaterials will help us align our research with industry needs and emerging trends, fostering a more application-oriented approach in both teaching and research.

Recommendations for future collaborations and research projects

To further advance our research in nanotechnology, we recommend establishing stronger collaborations with DRDO and other research institutions. Joint research projects focused on the development of new nanomaterials for specific applications, such as energy storage and biomedical devices, could be highly beneficial. Additionally, organizing regular knowledge exchange workshops and seminars with DRDO scientists will help keep us updated on the latest advancements and provide opportunities for collaborative innovation. Expanding our research into areas such as sustainable nanomaterials and nanotechnology-enabled solutions for societal challenges could also lead to impactful outcomes.

Acknowledgement of the organizers and hosts

We would like to express our sincere gratitude to the organizers and hosts at the DRDO Organisation Industry Academia Excellence Centre for facilitating this enriching visit. Their efforts in providing a comprehensive overview of their research and development activities, as well as their hospitality, made this visit a highly valuable learning experience. We appreciate the time and insights shared by the researchers and scientists, and we look forward to continued collaboration and knowledge exchange in the future.