



Name of the activity/Programme: Guest lecture organized by Department of Chemistry, BMSCE, Bangalore

Title: “The Science and Impact of Electroless Nickel Coatings in Aerospace and Beyond”

Resource person: Dr. J N Balaraju, Chief Scientist & Head Surface Engineering Division, CSIR National Aerospace Laboratories, Bangalore

Date of activity: 09-12-2025 at 11.30am in ISE Department seminar hall, 5th floor, PJ block.

Number of teachers participating in guest lecture: 11

Number of students participating in guest lecture: 56

About the lecture

The guest lecture highlighted the significant role of electroless nickel alloy coatings, particularly Ni–P and Ni–B systems, in advanced surface engineering applications due to their excellent coating uniformity, strong adhesion, and superior corrosion and wear resistance. The speaker explained the fundamentals of electroless deposition and emphasized its advantage over conventional electroplating, especially for complex geometries and non-conductive substrates. Special focus was given to the contributions of CSIR–NAL in developing highly reflective electroless nickel coatings for sun shield mirrors used in INSAT class satellites of ISRO. The successful fabrication of thick (>150 μm), adherent nanocrystalline nickel alloy coatings on difficult-to-plate substrates such as stainless steel for the Aditya mission of LEOS, ISRO, was discussed in detail. The lecture also addressed the industrial reliance on hard chromium coatings and the growing concerns regarding the toxicity and carcinogenic nature of hexavalent chromium compounds. As an eco-friendly alternative, the development of electroless nickel polyalloy and composite coatings was presented. The incorporation of ternary elements such as Cu, W, Sn, Mo, and Co into the nickel matrix was shown to significantly enhance mechanical and tribological properties. In addition, the codeposition of ceramic second-phase particles like alumina, silicon nitride, ceria, and titania were reported to yield coatings with wear resistance comparable to hard chromium. Practical case studies included coating high-speed drill bits and evaluating their drilling performance on difficult-to-machine stainless steels under dry conditions. The challenges associated with corrosion protection of magnesium alloys were also highlighted. A multilayer electroless coating system developed on AZ31B magnesium alloy at CSIR–NAL demonstrated excellent corrosion resistance. Furthermore, the lecture covered the development of electroless nickel polyalloy coatings on lightweight composite fibers for effective EMI shielding applications. Applications in microelectronics, particularly on copper substrates, were also discussed. Overall, the lecture provided valuable insights into sustainable surface engineering solutions for aerospace, electronics, and strategic sectors.

Outcomes

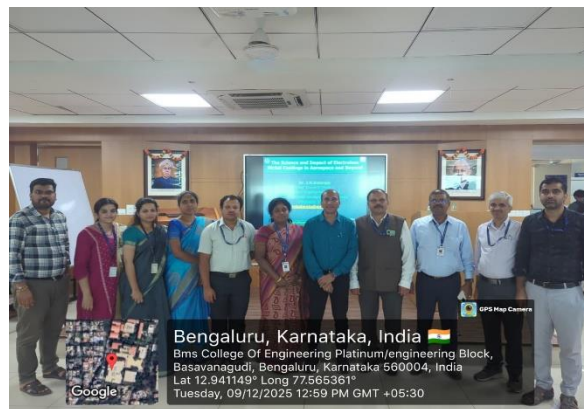
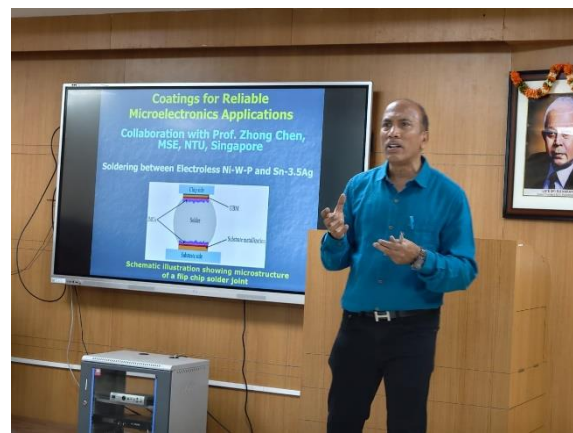
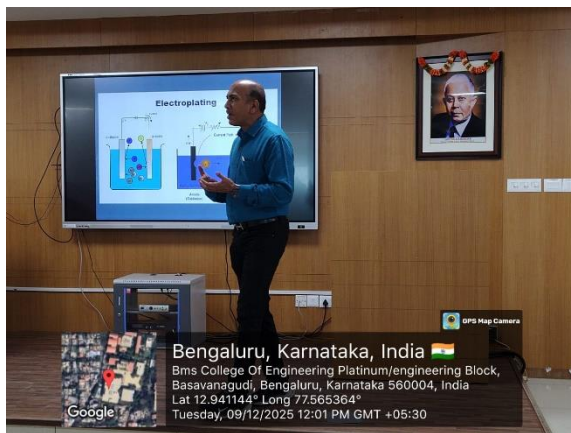
1. Undergraduate (UG) students gained a clear understanding of the fundamentals of electroless nickel coatings, their processing advantages, and real-world



Department of Chemistry

- industrial and aerospace applications, helping them relate classroom concepts to practical engineering solutions.
2. Professors and faculty members benefited from exposure to recent technological developments and successful case studies from CSIR–NAL and ISRO missions, which can be integrated into teaching, curriculum enrichment, and laboratory-oriented learning.
 3. Research scholars gained inspiration and direction for future research in sustainable coating technologies, composite and multilayer coatings, corrosion protection of light alloys, and functional coatings for aerospace, EMI shielding, and microelectronics applications.
 4. The lecture opened new perspectives on future research and industrial opportunities in electroless coating technologies, particularly in the development of environmentally benign, multifunctional, and smart coatings for emerging applications in space missions, electric vehicles, renewable energy systems, and next-generation microelectronic and lightweight structural materials.

Photographs of the guest lecture





Participant's attendance

I(C-P)

B.M.S. COLLEGE OF ENGINEERING
DEPARTMENT OF CHEMISTRY
Invited talk by
Dr. J N Balaraju
Chief Scientist and Head, Surface Engineering division, NAL, Bangalore
Attendance Sheet
Date: 09-12-2025

Sl.No.	Name of the Student	Semester	Branch	Signature
1.	Aditya Saurabh	I(C-P)	CSE	Aditya
2.	Adrian Ronnie S	I(C-P)	CSE	Adrian Ronnie
3.	Amaan Afzal Ahmed Khan	I(C-P)	CSE	Amaan Khan
4.	Akshay A.	I(C-P)	CSE	Akshay
5.	Aditya Raghunath	I(C-P)	CSE	Aditya
6.	Amogh Vashishta S	I(C-P)	CSE	Amogh
7.	ADVIK SAHA	I(C-P)	CSE	Advik
8.	Aditya Raj (USN-934)	I(C-P)	CSE	Aditya
9.	Aditya Yadav	I(C-P)	CSE	Aditya
10.	Aman MS	I(C-P)	CSE	Aman
11.	Aditya Raj (822)	I(C-P)	CSE	Aditya Raj
12.	Ahmed Hasan	I(C-P)	CSE	Ahmed
13.	Akshay Gupta	I(C-P)	CSE	Akshay
14.	Akshat Virek Mishra	I(C-P)	CSE	Akshat
15.	Aditya Raj (142)	I(C-P)	CSE	Aditya
16.	Akanksha Bhat	I(C-P)	CSE	Akanksha
17.	Adarsh A. Shetty	I(C-P)	CSE	Adarsh
18.	AKSHAYAK	I(C-P)	CSE	Akshay
19.	Aman Kumar Rao (898)	I(C-P)	CSE	Aman
20.	Aditya Vishnoi	I(C-P)	CSE	Aditya Vishnoi
21.	Aditya Keshav	I(C-P)	CSE	Aditya
22.	Ajay Kumar J R	I(C-P)	CSE	Ajay
23.	Aiyita puwa Rithvik	I(C-P)	CSE	Aiyita
24.	Akash	I(C-P)	CSE	Akash
25.	Amogh Krishna B	I(C-P)	CSE	Amogh
26.	Aditya Anil Hattikal	I(C-P)	CSE	Aditya
27.	Ara Venkata Abaya Laksh	I(C-P)	CSE	Ara
28.	Aditya Paul	I(C-P)	CSE	Aditya



I (C-D)

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Sl.No.	Name of the Student	Semester	Branch	Signature
1.	Pooja Mangurani	III I	Aerospace	Pooja
2.	Afreen Toj H	I	CSE	Afreen
3.	Aishwarya K.M	I	CSE	Aishwarya K.M
4.	Agastya Noel	I	CSE	Agastya
5.	Akshita Singh	I	CSE	Akshita
6.	AKSHITA	I	CSE	Akshita
7.	Akshita Kumari	I	CSE	Akshita
8.	Aishwarya Lakshmi V	I	CSE	Aishwarya
9.	Aishwarya Prasanna	I	CSE	Aishwarya
10.	Ahna Prasanna Rao	I	CSE	Ahna
11.	Aishi Bhar	I	CSE	Aishi
12.	Akanksha	I	CSE	Akanksha
13.	Amsutha T.G	I	CSE	Amsutha T.G
14.	Aishwarya Biswal	I	CSE	Aishwarya
15.	Anagha Bharadwaj	I	CSE	Anagha
16.	Amsutha S.H	I	CSE	Amsutha
17.	AKSHATA ULAGI	I	CSE	AKSHATA
18.	Adviti A	I	CSE	Adviti A
19.	Aishwarya Gonal	I	CSE	Aishwarya
20.	Akula Nakshatra	I	CSE	A Nakshatra
21.	Alur Rishitha	I	CSE	A-Rishitha
22.	Amsutha	I	CSE	Amsutha
23.	Ameshu P. S. S	I	CSE	Ameshu
24.	ANAGHA KL	I	CSE	Anagha
25.	AKSHATA C	I	CSE	Akshata
26.	Aditya S.L	I	CSE	Aditya
27.	Aditya B.K	I	CSE	Aditya
28.	Amam Kumar	I	CSE	Amam

email: puresmarjwari.se24@bmsce.ac.in

