

Report on two-days lecture workshop sponsored by National Academy of Sciences

(NASI-Bangalore Chapter)

Program details:

Name of the program	Two-days lecture workshop sponsored by National Academy of Sciences (NASI-Bangalore Chapter)-Advanced Materials, Bio-sustainability and Energy
Number of days:	2 days
Number of sessions	8 sessions
Convener	Prof. Chandrabhas Narayana
Coordinator	Dr. Sreeja P B
Number of colleges participated	10
Number of total participants	267
Number of outside participants	139
Speakers	Prof. Chandrabhas Narayana Prof. M. Easwaramoorthi Dr. Sebastian Peter Prof. Aninda J Bhattacharya, Prof. Umesh V. Waghmare,
General feedback from students	Excellent

Participants

1.	Pragathi College Vijayapura (Rural Bangalore)	17
2.	Jyothi Nivas, Bangalore	31
3	Vijaya College, Bangalore	14
4	Surana College, Bangalore	18
5	Maharani Science college for Women, Bangalore	14
6	Ramaiah College, Bangalore	3
7	The Oxford college of Science, Bangalore	29
8	Christ academy institute for advanced studies, Bangalore	8
9	Vivipura college, Bangalore	5
10	Christ University, Bangalore	97(PG), 18(UG), 8(Scholar) 15(Faculty)=128
	Total	267

Advanced Materials, Biosustainability and Energy

We started the first day with an inaugural ceremony, lighting of the lamp, inaugural address by Dr. Anitha Varghese, Head, Department of Chemistry and key note address by Prof. Chandrabhas Narayana, convener of the program (9.30-9.45am, 12/9/19). This was followed by the technical sessions.





First session:

Tailoring nanomaterials for Raman Applications in biotechnology

The morning session of the two days' seminar was addressed by **Professor Chandrabhas Narayana** who is the current Dean of Research and Development, JNCASR, Bangalore. It was chaired by Dr. Vinod T. P.

Prof. Chandrabhas shed light upon the topic- "Application of Raman Spectroscopy in Biotechnology". Raman spectroscopy is based on the phenomenon of scattering of light by the particles of a solution. Sometimes, the emitted frequency is greater than the incident one and sometimes it is lesser which leads to the formation of stokes and anti-stokes lines in the spectra. It is basically the study of the change in the vibrations of a molecule when a source of light is focused upon it. Raman spectroscopy provides information about a substance at a molecular level.

The following are the usage of Raman spectroscopy in Biotechnology

- Detection of atherosclerosis- The normal spectra of the artery tissue gives peaks of collagen, elastin, actin, lipids etc. However, the plagued artery tissue causes a shift in the spectra (at about 800-1000nm). This helps in the detection of blockage in heart or other parts of the body.

- Detection of breast cancer- Healthy tissues exhibits a peak at about 800nm but infected tissues have peak at about 1400-1500nm. Also, malignant tissues have crowded peaks instead of clear sharp peaks.
- In pharmaceutical industry- Raman spectroscopy is often used to check consistency and percentage composition of drugs. As concentration increases the extent of scattering, the Raman spectra is observed better when the solution is concentrated.
- Detection of HIV viral DNA- the affected fragment of DNA can be detected through SERS.

The next topic discussed was Surface Enhanced Raman Spectroscopy (SERS). SERS is a technique in which nanoparticles are used alongside lasers to enhance the efficiency of Raman spectroscopy.



Second session:

The second talk on 12/09/2019 (DAY-1) was given by **M. Eswaramoorthy**, Chemistry and Physics of Materials Unit, JNCASR, BANGALORE. the session was chaired by Dr. Yamuna Nair.

The talk started at 11:15 after a tea break. The title of the talk was ‘NANOPOROUS MATERIALS’.

The speaker started the session by noting the differences between the allotropes of carbon which was interesting to observe for audience in nanoscale.

He also spoke about the 'black beauty' that is charcoal and its importance in the field of material sciences. The session was very interesting as he explained the advantages of charcoal over diamond even though they are similar in their composition.

He continued explaining the classification of nanoparticles based on their pore size:- Microporous, Mesoporous, Macroporous.

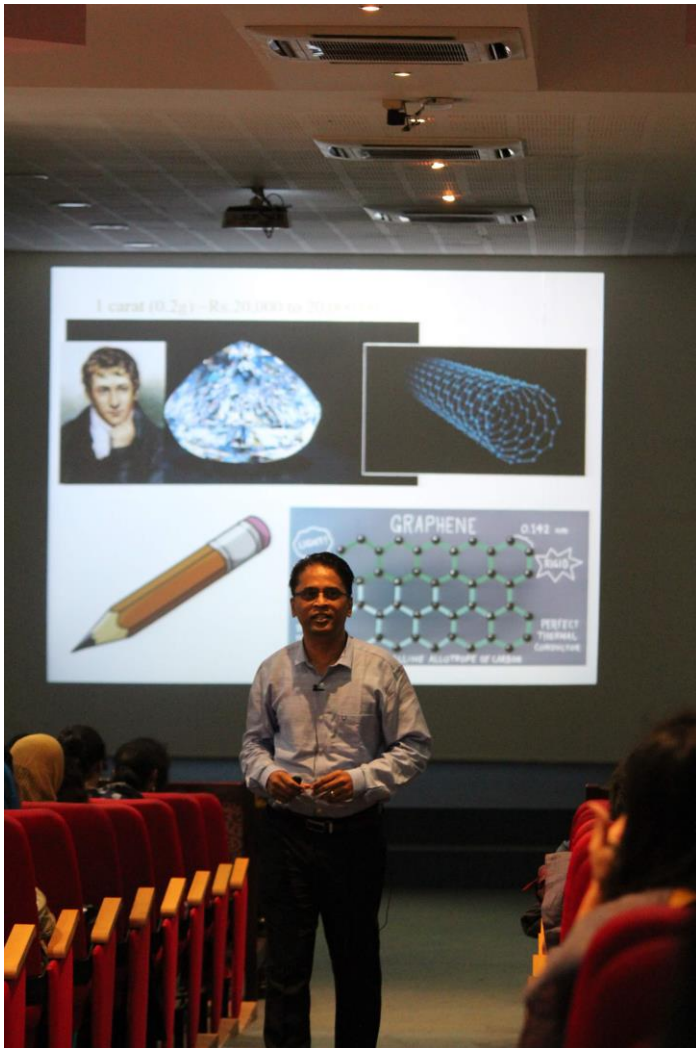
He explained about the shape selective catalysts such as zeolites, their properties, molecular structure, applications, their nanoproperties and their reactant selectivity.

The audience were curious to know about the product shape selectivity of zeolites. This was explained by quoting the example of selectivity of para-xylene over ortho and meta xylene by ZSM-5 channel pores.

He explained the application of nanoparticles in biological field. He mentioned about the insulin mediated glucose transport, different types of Diabetes, glucose responsive charge-reversal process. He also explained about the Non-covalent pore engineering which was very interesting.

The session was very interesting as the speaker explained the nanoporous particles from the basics which kept the students on track. It was a interactive session and the audience were curious to know about the future of nanoporous materials.

The session ended at 1:30pm.



Third Session

ENERGY STORAGE USING RECHARGEABLE BATTERIES

Prof. Aninda J Bhattacharyya, a faculty and the head of solid state and structural chemistry unit of IISc Bangalore, was the speaker on the third session of the first day. The session was chaired by Dr. Anil Agarwal.

The session titled “Energy storage using rechargeable batteries” was centred on making energy storage devices using cheaper methods. The talk was simple and informative as he started the session by brushing up on the basics of electrochemistry to his latest researches in the field of electrochemistry.

He began his session by focussing on the basic concepts, the materials used for making battery and different battery types. He then spoke about how energy is generated and stored, mainly focusing on the storage of energy in a battery. He gave us an insight on the environment friendly and electrochemical batteries and its consumer as well as industrial application. Advantages of crystalline solids over liquids as electrolytes were also discussed. He carried on with the session by talking about the latest developments in the field of batteries. Prof. Bhattacharya did a great job in simplifying a complicated subject, making sure it was understood by all.

In the research area, he mainly dealt with the alternatives to graphite which is used as an anode in the Li-ion battery. Alternatives to graphite that can be used are organic compounds, modified carbon, $B_xC_yN_z$ anode (Carbon is doped with boron and nitrogen), $g-C_3N_4$ anode and metal organic frameworks. He explained how lithium can be stored via alloying as well as insertion method and also mentioned the advantages of using organic electrodes. He also gave us insights about the metal-S battery.

Prof. Bhattacharya concluded by emphasising the need for further research in the subject that could help in producing more efficient batteries. The session was made more interesting by the questions asked by the students in the audience.



Fourth session

The fourth session was conducted by **Dr. Sebastian C Peter**, faculty of JNCASR, Bengaluru. He is co-founder and director of a start-up Breathe based on Bengaluru. The session was chaired by Dr. Sunaja Devi. It is a group of scientists, students, engineers, entrepreneurs, all having an objective of converting CO₂ emissions. He is one among the ten finalists of the global level competition XPRIZE. It was a great privilege to have him as a speaker for the workshop. He shared his experiences that he had gained from the global level competition.

The topic was 'Development of Integrated Scientific Technologies for Conversion of Industrial Waste CO₂ to Chemicals and Fuels'. Rather than choosing a complicated topic, he selected a simple relevant topic so that everyone could understand the concept well and he succeeded in it. He tried to explain the various processes involved in the most fundamental way.

The talk was so interesting. He explained about various aspects of CO₂, its sources, effects, etc. Excess of CO₂ not just cause global warming, climate changes, etc. but also has an adverse effect on the health conditions. So it is the need of the hour to reduce the CO₂ level and there lies the importance of his project. He explained about the various methods for the CO₂ reduction. Thermochemical, Photochemical, Electrochemical and Biochemical Methods. He discussed about the 17 direct products from CO₂ which can be further synthesised into various

useful chemicals. But it is not that easy because CO₂ is one of the most stable molecule and it is not that easy to activate it.

In the thermochemical method, he explained the production of methanol and also distinguished it from the reverse water gas shift method for the production of CO. Various mechanisms were also explained with the different catalyst. The wide applications of methanol like how it can be used as an alternative for Hydrogen, blender in fuels, etc was discussed. For the methanol, we don't have to change the gas stations and also it is highly safer than gasoline. George Olah along with Suryaprakash developed various CO₂-methanol, carbonate chemistry, etc in the 70s and 80s. He discussed about the journal 'Ni-Ga catalyst for CO₂' which inspired him into his present research. He explained some more papers, 'Direct Conversion of CO₂ into Liquid Fuels With High Selectivity Over a Bifunctional Catalyst' and 'Direct Conversion of CO₂ into a Gasoline Fuel'

Another method for the effective reduction of CO₂ is the electrochemical pathway. The basic fundamentals of the electrochemistry is being applied for it. Based on the potential applied the product formed varies. Therefore, suitable catalyst is being designed for this mechanism. He pointed out that a flower type morphology of catalyst rather than the normal flat surface provided more access of the reactants. He also discussed about the various steps involved.

Finally, he discussed about the photochemical pathways where we will be mimicking the nature. Here we will be using sunlight, water and CO₂. Also we will be using a material with a particular band gap so that the efficient absorption of solar energy occurs. He also further discussed some of the drawbacks of the mechanism.

He further gave us an outline about the working of his project. The most interesting part of the seminar was it. He explained how they get into this project and how it proceeded well. He explained the way in which they designed the suitable catalyst for the mechanism, the changes in the mechanism with each catalyst and also the properties of the different catalyst used. He also shared about the next step of his dream with us, a H₂ generation plant using solar energy where water will be the byproduct, which will be accomplished by 2021. He also gave us some brief outlook about the various aspects about the business associated with it by introducing some terms and conversions used for different calculation in the economical aspect. He introduced about a foundation XPRIZE which creates incentive competitions to involve the crowd to take part in the world's problem. We can reach solutions only if everyone can make their voices heard.

On overall we had a wonderful session with him. He was able to explain the relevance of the topic and also he explained all the mechanisms involved in a more basic way so that any average student can understand. It was a productive session and we look forward for such session.



Fifth session:

Computer stimulation to design new materials (nanomaterial)

The afternoon session of 2nd day seminar was addressed by **Prof. Umesh V. Waghmare**, his field of research is based on stimulation of condensed matter and material education. It was cherished by: - Dr. Riya Datta.

Prof. Umesh started his session by briefing about the importance of material study and properties of materials like diamond, gold, copper etc. he discussed about the challenges we face for stimulation. method of stimulation should be applicable to wide range of compounds, it should have parameter free model, cost effective. He spoke about the total energy of molecule can easily be calculated by using computers while it is difficult to do manually. After that he discussed about the density functional theory and its limitations. The various computer programs can be used for density functional theory are quantum espresso, ABINIT, SIESTA etc. After the tea break he shed light on 2D nanomaterials and technologies. In this topic he covered properties of graphene, it's structure, half effect, exotic physics involved in graphene, topological transport in graphene. Other than graphene he briefed about silane, hexagonal BN. Electron proton coupling in graphene. He also discussed about the stimulation of 2D materials. He ended his session by describing the use of AI (artificial intelligence) in designing of materials.



The two days session ended with valedictory function. Participation certificate for the participant were distributed by Dr. Anitha, Head, Department of Chemistry. We collected the feedback from all the participants.

Atithi Devo Bhava

(Organising a Workshop on 'Advanced Materials, Bio-sustainability and Energy')



Some people dislike going to workshops. Done wrong, they can be a huge waste of time and money. However, if they are planned well, they can be incredibly valuable for everyone involved. Workshops are great for brainstorming, interactive learning, building relationships, and problem-solving. This is why advance planning is critical.

Pertaining to the above fact, the Christites (MSc I and II) from the Department of Chemistry, CHRIST (Deemed to be University) meticulously planned out a two days workshop on “Advanced Materials, Biosustainability and Energy” under the supervision of Dr. Sreeja PB, Associate Prof, Dept. of Chemistry, CHRIST(Deemed to be University). All the aspects of the Workshop were carried out with immaculate management and patience. The student volunteers were divided into four groups, namely – Stage Committee, Hospitality Management, Reception Management and Discipline Team.

The Stage Committee members- Francis, Bhavana, Shiby, Sandeep, Philip, Kavya and Nishita took care of the stage lighting, the sound and the Projector. They patiently managed any technical glitch that occurred during the speech of the honourable Speakers.

The Hospitality Team- Swetha, Romina, Shema, Rose, Gokul, Gopika, Bincy, Keerthana, Sandra M and Sandra J engaged immensely during the food serving, snacks distribution and welcoming of the honourable guest Speakers.

Next was one of the most important committee that helped to keep the entire workshop in order. The reception committee took care of the registration of all the guest students, teachers and PhD scholars who came to attend the Workshop. They were present at all the shifts, the respected guest colleagues were about to arrive and cordially invited all with the kit (notebook,

pen, food-coupon and agenda for the programme). The committee members included Athira, Athulesh, Ninsha, Moulisha, Jiya, Chaitra, Roshini, George and Jonanthan from 1MSc and 2MSc Chemistry classes. There was a slight difference in the number of audiences from the number which had enrolled for the Workshop before.

The discipline committee comprising Deeksha, Bharath and Richu served as the pillar behind the entire Workshop and meticulously handled the sitting arrangement and the time management for the entire course of the two days Workshop.

The Workshop ended successfully and everyone felt contented with every aspect of the Workshop. A huge vote of thanks and gratitude were extended to the honourable guest Speakers for their time and incredibly good talk on the various topics.

Altogether, the closure statement to the Workshop can be stated as an amalgam of wilful knowledge gain, interactive learning and fun-loving event.

