

THRESHOLD

March Of Progress





INDIAN INSTITUTE OF TECHNOLOGY PATNA

**THE THRESHOLD CLUB
PRESENTS**



TRIBUNE
(A Magazine for Chemical Community)
VOLUME - 9

Designed by : Dheeraj Kalani

Oct 2017

CONTENTS

- ALL AROUND THE WORLD 4
- EXPLORE HOUSE 5
- INFORMATION ZONE 6
- CHEMISTRY IN EVERYDAY LIFE 10
- NOBEL LAUREATES OF CHEMISTRY 12
- RESEARCH BY PROFESSORS AT IITP 14
- THRESHOLD EVENTS AT CELESTA 2K17 17
- Q & A ZONE 19

All Around The World

1. Chemical engineers use gold to discover breakthrough for creating biorenewable chemicals!!

University of Virginia chemical engineers Robert J. Davis and Matthew Neurock have uncovered the key features that control the high reactivity of gold nanoparticles in a process that oxidizes alcohols in water. The research is an important first step in unlocking the potential of using metal catalysts for developing biorenewable chemicals. The scientific discovery could one day serve as the foundation for creating a wide range of consumer products from biorenewable carbon feedstocks, as opposed to the petroleum-based chemicals currently being used as common building blocks for commodities such as cosmetics, plastics, pharmaceuticals and fuels. For more details, follow this link: www.sciencedaily.com/releases/2010/10/101020101700.htm

R

E

S

E

A

R

C

H

2. Green light for ultra-fine display colors!!

Chemical engineers have succeeded in generating ultra-pure green light for the first time. The new light-emitting diode will pave the way for visibly improved color quality in a new generation of ultra-high definition displays for TVs and smartphones. For more details, follow this link: www.sciencedaily.com/releases/2017/09/170906103617.htm

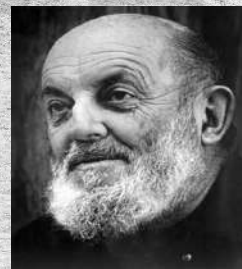


EXPLORE

OPEN HOUSE

“In wisdom gathered over time I have found that every experience is a form of exploration.”

— Ansel Adams



Chemistry vs. Chemical Engineering

One is often curious to know what's the difference between **Chemistry** and **Chemical Engineering**? Well in this section, we will understand and explore it...

Both disciplines deal with many of the same things and there is much overlap, but the basic differences are novelty and scale.

A chemist is more likely to be developing new compounds and materials; a chemical engineer is more likely to be working with existing substances. A chemist deals with small amounts of materials in glassware on a laboratory bench. The chemical engineer deals with large scale reactions with factory scale equipment. Chemists discover the chemical reactions by which useful products may be made. Chemical engineers discover the processes and develop the equipment that allows the chemical reactions to work economically. The academic training of chemical engineers provides a strong background for a variety of areas, including: Process design, Production engineering, Research and Development, Safety, Marketing/technical sales, Environmental and waste management, etc.

So from the above discussion, we can conclude that Chemistry is the branch of science concerned with the substances of which matter is composed, the investigation of their properties and reactions, and the use of such reactions to form new substances while Chemical Engineering deals with the design, development of processes and operation of machines and plants through which the physical or chemical state of materials undergo various changes.

Information Zone



This zone will make you encounter with the various companies and industries of India and their recruitment process and rules. This time we are coming with a well known name in the field of military's Research and Development, i.e.,

Defence Research and Development Organization (DRDO)

The Defence Research and Development Organisation (DRDO) is an agency of the Republic of India, charged with the military's research and development, headquartered in New Delhi, India. It was formed in 1958 by the merger of the Technical Development Establishment and the Directorate of Technical Development and Production with the Defence Science Organisation. It is under the administrative control of the Ministry of Defence, Government of India.

With a network of 52 laboratories, which are engaged in developing defence technologies covering various fields, like aeronautics, armaments, electronics, land combat engineering, life sciences, materials, missiles, and naval systems, DRDO is India's largest and most diverse research organisation. The organisation includes around 5,000 scientists belonging to the Defence Research & Development Service (DRDS) and about 25,000 other scientific, technical and supporting personnel.

Defence Research and Development Organization works under Department of Defense Research and Development of Ministry of Defense. DRDO every year conducts a Scientist Entry Test (SET) on all India basis for the recruitment of scientists 'B' posts. A huge number of candidates appear for DRDO SET test.

DRDO SET is conducted on all India basis in the month of September, depending on the requirements, in order to provide equal opportunity to all students from different educational institutions in view of the increasingly wide variation in the marking pattern of different educational institutions in the country.

Important Date: The advertisement generally appears during the month of April / May every year.

DRDO SET Exam Eligibility Criteria and Application Form :

Candidates having first class bachelor degree (minimum 60 % marks) in engineering, technology, electronics, communication, mechanical engineering and computer science can apply for SET exam.

Age Limit for DRDO SET Exam is 28 years and You must be a citizen of India to apply :

Application forms are available with information brochure at designated branches of State Bank of India or forms are also published on the official website. General/OBC candidates on payment of Rs. 300/- (Rs. 100/- for the application form with information brochure and Rs. 200/- as Exam. Fees). For SC/ST candidates, there is no exam fee and the application form with information brochure will be available to them on payment of Rs. 100/- only.

DRDO SET Exam Pattern :

DRDO SET exam consists of two stages –Written test followed by Interview. Marks you score in DRDO SET Written test is not carried forward but is just used for screening candidates for Interview. Final selection is based on the performance in the interview only.

DRDO SET Written test is 3-hour long with two sections :

Section A: Subject Knowledge (BE/ BTech (for Engg discipline) or MSc (for Science Discipline))

Section B: Aptitude for Applied Research & Development.

Recruitment Through Gate :

1. Only Indian nationals need apply.
2. Candidates must have obtained atleast a first class in their qualifying exam equivalent to 60%. In case of non-availability of the conversion formula, CGPA/CPI of 6.75 (for a 10 point scale) will be taken as equivalent to 60%.

- 3. As per AICTE guidelines. For any other point scale of CGPA/CPI, the equivalence may vary proportionally.
- 4. Knowledge of German, French, Russian, Japanese or Chinese is desirable but not mandatory.
- 5. The upper age limit not exceeding 28 years. Relaxation will be as per Govt guidelines.

Chemistry	At least first class Master's Degree in Chemistry from a recognized university or equivalent.	Chemistry(CY)	1 Chemistry 2 Organic Chemistry 3 InorganicChemistry 4 AnalyticalChemistry 5 Physical Chemistry
Chemical Engg.	At least first class Bachelor's Degree in Engineering or Technology in Chemical Engg. from a recognized university or equivalent.	Chemical Engineering (CH)	1.Chemical Engg. 2.Chemical Engg. / Chemical Tech. 3.Chemical Plant Engg. 4.App. Chemical and Polymer Tech. 5.Polymer Tech. & Chemical Technology

Chemistry *in* *Everyday* *Life*

Rosalind Franklin once stated that-"Science and Everyday Life CANNOT and SHOULD NOT be separated".

He was absolutely correct in saying this and the same principle follows for Chemistry. Chemistry is entangled to our daily life. It can be found easily. The air we breathe, the food we eat, the filtered water we drink, the clothes we wash, etc. Chemistry is indeed in our everyday. You yourself are a big bag of chemicals. Hence, it's become important to deal with it.

This time we are coming with an interesting section which flies around the following stated question that,

Why do we use Alloys in daily life instead of pure metal?

People use metallic products in daily lives. There is a fact that most of the metallic products are not made from pure metals. People usually use alloys instead of pure metals due to alloys' better properties.

What are alloys? They are mixtures of at least two or more different elements. At least one of these elements must be metal. For example, steel is a mixture of iron and carbon, and bronze is a mixture of copper and tin. In alloys, there are two essential parts: main metal and alloying agent. The main metal can also be called as

parent metal or base metal, and it usually occupies 90% of the mixture. Also, the alloying agent can be either metal or nonmetal. Most alloys are solid solutions, and some of them are chemically bonded.

Alloys have two different structures: interstitial and substitution.

How do alloys work? They are mixtures of at least two elements; therefore, besides main metals' properties, alloys' properties can be influenced by elements added in the parent metal. For example, steel is harder than iron. Iron atoms can slip over other iron atoms, because metallic bonds can hold metals together. However, if carbon atoms are added to iron, the iron atom will not be able to slip easily, so it becomes harder than pure iron. Steel can be used for construction because pure iron is soft and can be easily broken.

Consequently, people tend to use alloys instead of pure metals because alloys have more and better properties than their parent metals. Also, alloys can be used for different areas, such as medicine, architecture, art and military. Pure metal does not have strength. Pure metal also does not have the specific features which are desired by the people. So we add other metal elements to bring out their features. The metal has to be soft to make such shape. So we add copper and small amount of Magnesium and Zinc. The material when mix is soft while making shape but it becomes rigid after that.

Nobel Laureates of Chemistry



Alfred Nobel

There is no other prize in the intellectual realm with the prestige of the Nobel Prizes. But why are they important? What do they contribute to society? In an age in which we are gradually losing whole sets of values, fundamentally humanistic ones, the Nobel Prizes are one of our last bastions. We seek in them a reference, not only of excellence, but of honesty, enthusiasm, commitment to ideals, that inspires both laymen and professionals.

Those people who confer the "greatest benefit for mankind" in physics, chemistry, physiology or medicine, literature, and peace are awarded with this prize. Of all the Nobel Prizes, those of Science – Medicine, Physics and Chemistry – have a more fundamental character.

In this section, we will discuss about the Nobel Prize Winners in Chemistry.

The Nobel Prize in Chemistry 2016 was awarded jointly to Jean-Pierre Sauvage, Sir J. Fraser Stoddart and Bernard L. Feringa "for the design and synthesis of molecular machines".



Jean-Pierre Sauvage
Prize Share - 1/3



Sir J. Fraser Stoddart
Prize Share - 1/3



Bernard L. Feringa
Prize Share - 1/3

Work of Jean-Pierre Sauvage :

We can imagine that the components of the smallest machines could be molecules. For a machine to function, its parts must be able to move relative to each other. In 1983, Jean-Pierre Sauvage managed to achieve this by connecting two ring-shaped molecules into what is called a "catenane". Unlike ordinary chemical bonds, the molecules in catenanes are linked like a chain, where the links can move relative to each other.

Work of Sir J. Fraser Stoddart :

We can imagine that the components of the smallest machines could be molecules. For a machine to function, its parts must be able to move relative to each other. Fraser Stoddart has contributed to the development of molecular machines, for example by developing a "rotaxane" in 1991. A ring-shaped molecule was threaded over another molecule that functions like an axle.

Work of Bernard L. Feringa :

We can imagine that the components of the smallest machines could be molecules. For a machine to function, its parts must be able to move relative to each other. Bernard Feringa has contributed to the development of molecular machines. For example, in 1999 he constructed a molecular motor by making a molecular rotor blade continuously spin in the same direction.

In the future, molecular machines could be used for new materials, sensors, and energy storage systems.

For more details you can archive to the link given below:

https://www.nobelprize.org/nobel_prizes/chemistry/laureates/2016/popular-chemistryprize2016.pdf

Research by Professors At IITP

This section will account with the various informative researches and articles of professors of the Department of Chemical and Biochemical Engineering.

Following extract is the article of
Assistant Professor Dr. Nitin Dutt Chaturvedi
on the topic :



Maximising heat recovery in batch processes via product streams storage and shifting

Abstract

In a batch process, either direct or indirect heat integration may be employed. The former involves direct heat transfer from hot to cold process streams. In the latter, heat from a hot process stream is first transferred to an intermediate fluid where the heat is stored until it is finally transferred to a cold stream. Storage of product streams allows direct heat integration to be delayed, thereby providing an opportunity for energy conservation while avoiding the use of an intermediate fluid. This paper presents a new methodology for batch heat integration that involves the direct storage of product streams within the procedure to set the minimum utility targets. Application of the proposed methodology on illustrative examples demonstrates that significant energy reduction can be achieved by shifting product streams on the time scale. Potential reductions of 33.2% cold utility and 45.1% hot utility were estimated for the first example when the product stream was stored. Similarly, reductions of 3.5% cold utility and 6.5% hot

utility were observed for a two-product batch plant when the cooling requirement for one of the products was shifted on time scale.

Introduction

Batch processes offer the flexibility and adaptability that are vital for a manufacturing plant to produce varieties of products. Procedure for the design and synthesis of a batch process is more complex than that of a continuous process due to the need to consider time as a variable in a batch process. Over the years, increasing batch process efficiency, minimizing make-span and maximizing productivity have been the subjects of extensive research.

Problem Definition

The general problem to target the minimum utility for a batch process is defined next. Given,

a set of cold process streams (C_j) that exist within a fixed time interval at their specified supply and target temperatures, and with defined heating requirement,

a set of hot process streams (H_i) that exist within a fixed time interval at their specified supply (T_{sup}) and target (T_t) temperatures, and with defined cooling requirements,

a subset (C_{jn}) for cold process streams (C_j) and a subset (H_{im}) for hot process streams (H_i) which can be stored directly (product streams).

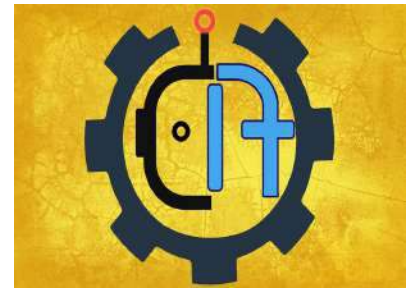
The objective is to determine the minimum external utility requirement by exploiting the flexibility to shift cooling or heating or demands of product streams on the time scale.

Conclusions

A new methodology has been proposed to set the utility targets for a batch process prior to detailed design of the HEN. The procedure includes the possibility of shifting the cooling or heating demand of product streams. The proposed methodology considers the intra-time interval integration for different stream categories, and utilises principles of inter-plant heat integration.

It has been proven that, after the elimination of heat recovery pockets, the surplus heat from the intermediate GCC of an interval, along with residual product streams, can be integrated with heat demands at later intervals. The proposed methodology is limited to a fixed-schedule batch process. However, exploring and exploiting the scheduling flexibility while observing the production constraints could potentially result in further utility reduction. It should be noted that the current methodology employs the flexibility of shifting of product streams. The time flexibility of the feed and intermediate streams may also be employed to further reduce energy consumption.

CELESTA 2K17



Celesta is the annual Techno-Management Fest of IIT Patna. Every year Celesta is a host to a plethora of events and competitions with active participation from the students of IIT Patna. Now, it has also been extended to other colleges as well.

The technical as well as management activities are organized with the help of inputs from various clubs.

Along with the other clubs, ThC is also highly involved in the fest and presents to you the following exhilarating events :

THRESHOLD EVENTS IN CELESTA 2K17



Macaroni and cheese
Everybody freeze!!

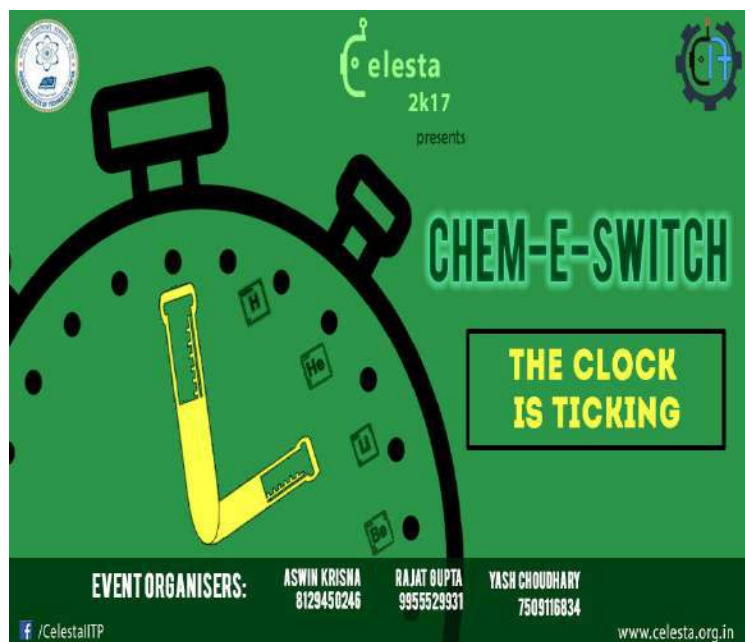
In Celesta' 17, the Threshold Club
presents you,
The “**Rocket Propulsion**”.

Bottle with head and flow
Ready to fly with a blow
It's time for you to win and glow.

"Everything ends with chemical, if it doesn't its not the end...".

From the threshold club, IIT Patna we present you the multi-level treasure hunt i.e. 'Chemoquest'.

Scroll your mind and solve the clues, be the first to complete the hunt, and then perform a chemical reaction from the compounds you earned. 'Celesta is here...'

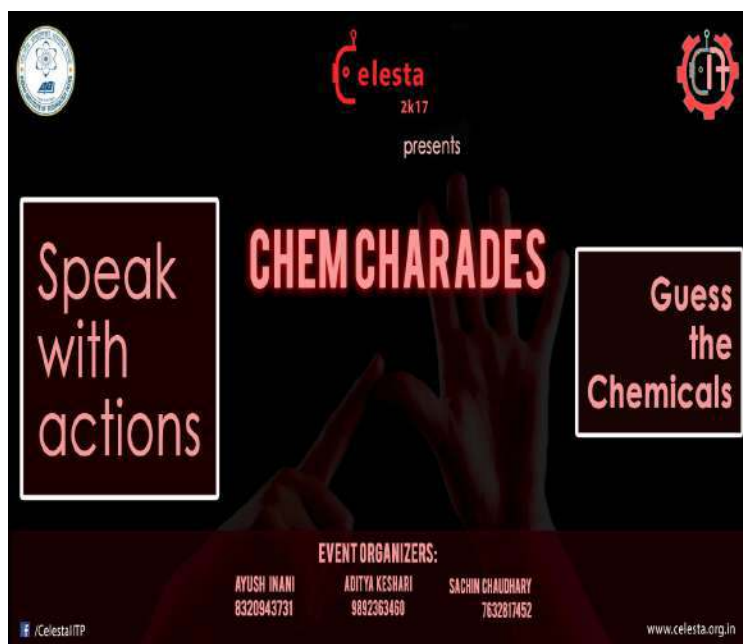


Are you that budding engineer who gets super-excited while tinkering with chemicals? Are you amazed by the variety and versatility of reactions that happen to matter around us? Then this event is perfect for you. Just use any **chemical reaction** to control a simple electrical circuit we've made for you. Gear up as we are super-psyched to bring out the chemical engineer in you.

Ever played Dumb Charades?
Well Chem Charades is its version 2.0!

You will be given properties of a compound / element and you will have to explain it to your partner.

Act like DiCaprio or Dance like MJ,
You just can't speak!



Q & A ZONE

*For the one, who with experience learns,
A Dream, an Ambition, it is all attainable.
All you need to do is believe,
A hope, some faith, will find its way.*

Yes guyz, its true that experience matters a lot and that can be used as a powerful tool to attain one's ambition.

This section focusses on the same, i.e, the experience gained by the people during their internships, what kinds of problems they faced and how they accomplished and resolved those finally. Also, the advices and suggestions which they are giving are also very valuable.

This time, we have with us someone, who can really teach us much more than the above mentioned things, who is pretty smart, enthusiastic, explorer and motivating.

Yes, I am talking about [Miss Apoorva Shrivastava](#), Final year CST student who did her internship in US this past summer, which most of us only can dream. Take a look on a chat session she had with us sharing her memorable experience .



ThC : Please tell us about your internship in detail in this past summer.

Apoorva : I went to Oregon Health and Science University, Portland USA. It was a paid research internship under the guidance of Prof. Daniel Zuckerman, Dept of Biomedical Engineering. There I worked on a software

for Estrogen Receptor docking with different ligands. The development of this software has been in action since a few years and my major contribution was in the analysis by applying clustering on the data obtained.

About the stipend : He was generous enough to pay me \$1500 after taxes with reimbursements for insurances and they booked my flight tickets too. Moreover, don't compare the stipend if you are getting any, because it would depend on the kind of place you are living in, the expenses are different everywhere, consult someone experienced about the place.

ThC : What problems did you encounter while applying for such internships? How did you approach for it and ultimately acquired the same?

Apoorva : What you do while applying for an internship is you write to the people you are willing to work with, but it's very difficult to get responses and even if you get responses they might not be positive, some would say that they don't have funds, some would say they have no space in the lab. See if they are responding to your mail means your profile was strong enough to make them write or they were kind enough to reply, in both the cases you can take it as an opportunity. There is a trick here, everyone has money and everyone has space, the only thing they want to know is how much are you willing for this internship, how badly do you want the work. I got six or seven replies and most of them were negative out of the 200+ mails that I wrote, only two of them were exact positive but stipend was less. I replied them all with all the enthusiasm I ever had and I got them to pay me more or find ways to get my trip sponsored and at the end Dan(who was then working at Univ. of Pittsburgh) agreed to get me sponsored and we had a few skype chats and that was it.

ThC : What kinds of problems did you face there? How did you manage them? How is it like to work with different people in different surroundings?

Apoorva : The whole process was on mails and skype chats. From flight booking to visa, there was a lot of a paper work but all went well. All thanks to the HR Rebecca Bambusch, who took care of it all very well. But still there was a lot to handle. On the very first day when I went to the house, I was supposed to live in, was locked and I didn't knew the door lock code. I was too tired after the flight to move with the heavy luggage anywhere but somehow I mailed everyone I knew in Portland with the wifi I got in the nearest emergency room at OHSU hospital and the HR came to rescue me. I got into the house in the evening. It was just a miscommunication with the house president about my time of arrival that led to me being homeless in the USA for a day.

This is all I remember as a problem because after that day, I knew that I am alone here but I can find solutions to my problems. I can find wifi if my sim card doesn't work. I can cook if the food is expensive and I can walk if it's sunday and no buses are running in my area or anything that comes up. I knew I can do something for anything that can go wrong.

The people there were very helpful and affable. There were four post-doctoral students under Dan and my mentor Barmak was very helpful. He used to explain me things that we discussed with Dan for hours after work and was very patient with me. Because of him, I learned a lot of new tricks and softwares and he was the one who helped me to cope up with the speed of my professor. The work culture was not very strict, I used to work full time from Monday to Friday and then Weekend fun(really really fun!). I lived in a co-op and had 21 housemates. They all were medical or PhD students and were always ready to take me out on the weekends and help

with things that were new for me. I also made some good Indian friends in my neighbouring labs, and they invited me home and treated me like their family from India. I have been to places and met a lot of people but Portland will always remain close to my heart.

**ThC : Can any type of person afford internships in abroad?
If not, what measures one should obtain?**

Apoorva : I think that people with firm belief on themselves and having positive hope can lead them to what they desire.

If you are asking about economical affordability, then there are a lot of online abroad internships that pay you well and also you can always reach out to professors for funds as I have mentioned in the above questions. And if you are talking about emotional affordability, one should be self-confident of her / his own capabilities. I had made my mind of doing research and after doing an internship at JNCASR Bangalore I knew I should try abroad next year and being very avid about the same I took on to it. And being a very talkative and friendly person, it was easy for me to make friends and adapt to the living style and work culture there.

ThC : In what sense your internships work is benefitting you? And what are your future plans?

Apoorva : Other than being an awesome experience in my life, my internship would get me two credits, a recommendation, probably a paper and many good friends.

I am planning to pursue higher studies in the same field.

ThC : How one should know his/her area of interest? Also, please give some valuable suggestions to our juniors.

Apoorva : It's difficult to find your area of interest, as you would like whatever you know the best and for that you will have to know it in first place, but how do you know that you might be interested in it and by the time you know start knowing it, an interest automatically develops. There are infinite topics and an ocean of opportunities. One would have to take chances and take one that looks easier or is something that they can relate to or find motivation in doing so. So start with something, actually anything and you would know either you like it and carry on with it or at least cancel from the list. This worked for me after crossing robotics and entrepreneurship that most of the youngins these days are fascinated by. Do whatever you like to, but do something. Having a list of failures is better than having nothing at all. And be fearless, fear eats your potential. You can do anything, really anything, you just need to believe that you can.

Thank You for your time, the most thoughtful gift of all!!