IPS Academy

Institute of Engineering & Science

Department of Chemical Engineering

Annual Magazine 2018-19

B' Reactive

from the Editor

Dear Readers,

Welcome to the 7th edition of chemical engineering IPS Academy, Institute of Engineering & Science departmental magazine. It is our ecstasy to acquaint you with the blooming colors of chemical engineering through our annual magazine B'Reactive. This magazine would help you to branch out with different aspects and practical application of chemical engineering keeping the objective to familiarize and creating awareness of chemical engineering among students. Let us together explore through various implementation of the same. We would like to thank the management of IPS Academy, Institute of Engineering and Science and would like to appreciate all the reviewers and authors for sharing their ideas.

We expect that this magazine would help you to expand your views on chemical engineering and their implementation.

Editors…

Words From the Desk of Head of Department

This decade is a time of unparalleled growth and change for India, with the opening up of the frontiers of the world through globalization, there is a need for efficient competence in the global scenario. This need for competence is what that drives our Department to strive for the pinnacle of success. Since its inception in the year 2004, the Department has always strived to create a cadre of professionals who are technically and professionally proficient.

The Department prides itself on preparing the students for creative careers in industries, academia and Government agencies. 450 numbers of students have successfully graduated and are catering to the needs of society. Our accomplished courses and adept faculties not only endeavor to cover the complete syllabus but to motivate students to learn beyond the syllabus which definitely develops complete knowledge of the subject (practical and theoretical) and develop skill sets of students to become promising engineers in future.

As per the need of current growing trend, the department have initiated post graduation course from 2011 in Chemical Engineering with specialization “Computer Aided Chemical Process Plant Design”. The Department has been successfully carrying out testing & IEDC projects over three years.

Dr. Rajesh Kumar Kaushal
Head
IPS Academy
Institute of Engineering & Science
Department of Chemical Engineering

Message from the Principal

Technical Education is the most potential instrument for socio-economic change. Presently, the engineer is seen as a high-tech player in the global market. Distinct separation is visible in our education between concepts and applications. Most areas of technology now change so rapidly that there is a need for professional institutes to update the knowledge and competence.

Institute of Engineering and Science, IPS Academy is a leading, premium institution devoted to imparting quality engineering education since 1999. The sustained growth with constant academic brilliance achieved by IES is due to a greater commitment from management, dynamic leadership of the president, academically distinctive and experienced faculty, disciplined students and service oriented supporting staff.

The Institute is playing a key role in creating and ambiance for the creation of novel ideas, knowledge, and graduates who will be the leaders of tomorrow. The Institute is convinced that in order to achieve this objective, we will need to pursue a strategy that fosters creativity, supports interdisciplinary research and education. This will also provide the students with an understanding and appreciation not only of the process of knowledge creation, but also of the process by which technology and knowledge may be used to create wealth as well as achieve social economic goals.
I am delighted to note that the engineering graduates of this institute have been able to demonstrate their capable identities in different spheres of life and occupied prestigious position within the country and abroad. The excellence of any institute is a measure of achievements made by the students and faculty.

Dr. Archana Keerti Chowdhary
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IIChE STUDENTS' CHAPTER

Content

Solar Pond (Solar Thermal Energy Collecting System)

Description:

A solar pond is, simply, a pool of saltwater which collects and stores solar thermal energy. The saltwater naturally forms a vertical salinity gradient also known as a "halocline", in which low-salinity water floats on top of high-salinity water. The layers of salt solutions increase in concentration (and therefore density) with depth. Below a certain depth, the solution has a uniformly high salt concentration.

When the sun's rays contact the bottom of a shallow pool, they heat the water adjacent to the bottom. When water at the bottom of the pool is heated, it becomes less dense than the cooler water above it, and convention begins. Solar ponds heat water by impeding this convection. Salt is added to the water until the lower layers of water become completely saturated. High-salinity water at the bottom of the pond does not mix readily with the low-salinity water above it, so when the bottom layer of water is heated, convection occurs separately in the bottom and top layers, with only mild mixing between the two. This greatly reduces heat loss, and allows for the high-salinity water to get up to 90 °C while maintaining 30 °C low-salinity water. This hot, salty water can then be pumped away for use in electricity generation, through a turbine or as a source of thermal energy.

Advantages and disadvantages:

The approach is particularly attractive for rural areas in developing countries. Very large area collectors can be set up for just the cost of the clay or plastic pond liner. The accumulating salt crystals have to be removed and can be a valuable by-product and a maintenance expense. No need for a separate collector. The extremely-large thermal mass means power is generated night and day. Relatively low-temperature operation means solar energy conversion is typically less than 2%. Due to evaporation, non-saline water is constantly required to maintain salinity gradients.

Efficiency:

The energy obtained is in the form of low-grade heat of 70 to 80 °C compared to an assumed 20 °C ambient temperature. According to the second law of thermodynamics, the maximum theoretical efficiency of a cycle that uses heat from a high temperature reservoir at 80 °C and has a lower temperature of 20°C is 17%.

By comparison, a power plant's heat engine delivering high-grade heat at 800 °C would have a maximum theoretical limit of 73% for converting heat into useful work. The low efficiency of solar ponds is usually justified with the argument that the 'collector', being just a plastic-lined pond, might potentially result in a large-scale system that is of lower overall leveled energy cost than solar concentrating system.

Development:

Further research is aimed at addressing the problems, such as the development of membrane ponds. These use a thin permeable membrane to separate the layers without allowing salt to pass through.

Alisha Mansoori (2st Year)

Capturing CO_2 from Ambient Air Using A Polyethyleneimine–Silica Adsorbent in Fluidized Beds

Carbon Capture and Storage (CCS) uses a combination of technologies to capture, transport and store carbon dioxide (CO_2) emissions from large point sources such as coal or natural gas-fired power plants. Capturing CO_2 from ambient air has been considered as a carbon-negative technology to mitigate anthropogenic CO_2 emissions in the air.

The performance of a mesoporous silica-supported polyethyleneimine (PEI)–silica adsorbent for CO_2 capture from ambient air has been evaluated in a laboratory-scale Bubbling Fluidized Bed (BFB) reactor. The air capture tests lasted for between 4 and 14 days using 1 kg of the PEI–silica adsorbent in the BFB reactor. Despite the low CO_2 concentration in ambient air, nearly 100% CO_2 capture efficiency has been achieved with a relatively short gas–solid contact time of 7.5 s. The equilibrium CO_2 adsorption capacity for air capture was found to be as high as 7.3 wt%, which is amongst the highest values reported to date. A conceptual design is completed to evaluate the technological and economic feasibility of using PEI–silica adsorbent to capture CO_2 from ambient air at a large scale of capturing 1 Mt-CO_2 per year. The proposed novel “PEI-CFB air capture system” mainly comprises a Circulating Fluidized Bed (CFB) adsorber and a BFB desorber with a CO_2 capture capacity of 40 t-CO_2/days.

Large pressure drop is required to drive the air through the CFB adsorber and also to suspend and circulate the solid adsorbents within the loop, resulting in higher electricity demand than other reported air capture systems. However, the Temperature Swing Adsorption (TSA) technology adopted for the regeneration strategy in the separate BFB desorber has resulted in much smaller thermal energy requirement. The total energy required is 6.6 GJ/t-CO_2 which is comparable to other reference air capture systems. By projecting a future scenario where decarbonization of large point energy sources has been largely implemented by integration of CCS technologies, the operating cost under this scenario is estimated to be \$108/t-CO_2 captured and \$152/t-CO_2 avoided with an avoided fraction of 0.71. Further research on the proposed 40 t-CO_2/day ‘PEI-CFB Air Capture System’ is still needed which should include the evaluation of the capital costs and the experimental investigation of air capture using a laboratory-scale CFB system with the PEI–silica adsorbent.

Shubham Joshi (3rd Year)

Impact and Need of Chemical Engineering in National Economic Growth

Chemical engineering is not only concerned with the contribution of it in the engineering sector, but also concerned with the global economy, nation's economy and GDP.

In the structure of the engineering chemical engineering is the one of the fundamental branch to strengthen the whole practical approach of engineering to the world.

There are many spheres in Indian education system and engineering is one of them but there are many factors in our country due to which engineering which is the crucial component of this sphere is affected like politics, ground problems of Indian society.

There is a connection between or we can say a thin line between politics and engineering. We can explain this point by taking any sector of engineering like chemical engineering, as india is changing In many ways. Slowly from recent years we are going to the market of capitalization but our country is unfit for it mix economy is well suited for us as people residing in our country is from different- different financial status. Currently, Inflation is going on 1 dollar is equivalent to more than 70 rupees this will emphasis on our import sector like 80 percent fuel oil in our country is coming from other countries mainly from Saudi Arabia so as our rupee currency is going down so we have to give extra money for same quantity and this will effect our economic growth by inflation money regulation will also be effected.

Now for reducing the money which we are giving to other country to supply petrol we are doing blending of ethanol in petrol. Ethanol is a crucial chemical and in various sectors of chemical engineering it is used like in refineries, pharmaceutical industries and many other and blending of ethanol in petrol will save more than ten thousand cores of money and this will increase our GDP and economic growth.

So, for this blending of ethanol requires more production of ethanol and for it chemical requirements will be increased, technology should be more efficient and this will require great strategies by chemical engineers and personal concerned with this field.

Bio fuel refineries in much amount will be needed contribution of Maharatna oil companies will be needed and also very technical study related to chemical engineering in accordance with chemical management will needed and when this big refineries, chemical firms will be installed in various sectors so in great quantity waste water will be discharged and many other chemical waste will be generated so for this there will be requirement of chemical engineers again.

Conclusion of this article is that chemical engineering is very important component of the global technological structure and adaptation of trends in chemical engineering is must and time to time there should be global innovations related to it.

Hardik Jain (4th Year)

Desalination

Desalination is a process that extracts mineral components from saline water. More generally, desalination refers to the removal of salts and minerals from a target substance, as in soil desalination, which is an issue for agriculture. Saltwater is desalinated to produce water suitable for human consumption or irrigation. One by-product of desalination is salt. Desalination is used on many seagoing ships and submarines. Most of the modern interest in desalination is focused on cost-effective provision of fresh water for human use. Along with recycled wastewater, it is one of the few rainfall-independent water sources.

Due to its energy consumption, desalinating sea water is generally more costly than fresh water from rivers or groundwater, water recycling and water conservation. However, these alternatives are not always available and depletion of reserves is a critical problem worldwide. Currently, approximately 1% of the world's population is dependent on desalinated water to meet daily needs, but the UN expects that 14% of the world's population will encounter water scarcity by 2025.

Desalination is particularly relevant in dry countries such as Australia, which traditionally have relied on collecting rainfall behind dams for water. Desalinated water is usually healthier than water from rivers and ground water, and there is less salt and lime scale in it.

According to the International Desalination Association, in June 2015, 18,426 desalination plants operated worldwide, producing 86.8 million cubic meters per day, providing water for 300 million people. This number increased from 78.4 million cubic meters in 2013, a 10.71% increase in 2 years. The single largest desalination project is Ras Al-Khair in Saudi Arabia, which produced 1,025,000 cubic meters per day in 2014, although this plant is expected to be surpassed by a plant in California. Kuwait produces a higher proportion of its water than any other country, totaling 100% of its water use.

Membrane separation requires driving forces including pressure (applied and vapor), electric potential, and concentration to overcome natural osmotic pressures and effectively force water through membrane processes. As such, the technology is energy intensive and research is continually evolving to improve efficiency and reduce energy consumption. Seawater desalination has the potential to reliably produce enough potable water to support large populations located near the coast. Numerous membrane filtration seawater desalination plants are currently under construction or in the planning stages up and down California's parched coast, with the 50 million gallons per day (mg) Carlsbad Desalination plant scheduled to be operational by 2016.

Reverse osmosis (RO) and Nan Filtration (NF) are the leading pressure driven membrane processes. Membrane configurations include spiral wound, hollow fiber, and sheet with spiral being the most widely used. Contemporary membranes are primarily polymeric materials with cellulose acetate still used to a much lesser degree. Operating pressures for RO and NF are in the range of 50 to 1,000 psig (3.4 to 68 bar, 345 to 6896 kPa).

Electro Dialysis (ED) and Electro Dialysis Reversal (EDR) processes are driven by direct current (DC) in which ions (as opposed to water in pressure driven processes) flow through ion selective membranes to electrodes of opposite charge. In EDR systems, the polarity of the electrodes is reversed periodically. Ion-transfer (perm-selective) anion and cationmembranes separate the ions in the feed water. These systems are used primarily in waters with low total dissolved solids (TDS).

Forward osmosis (FO) is a relatively new commercial desalting process in which a salt concentration gradient (osmotic pressure) is the driving force through a synthetic membrane. The feed (such as seawater) is on one side of the semi permeable membrane and a higher osmotic pressure "draw" solution is on the other side. Without applying any external pressure, the water from the feed solution will naturally migrate through the membrane to the draw solution. The diluted solution is then processed to separate the product from the reusable draw solution.

Membrane Distillation (MD) is a water desalination membrane process currently in limited commercial use. MD is a hybrid process of RO and distillation in which a hydrophobic synthetic membrane is used to permit the flow of water vapor through the membrane pores, but not the solution itself. The driving force for MD is the difference in vapor pressure of the liquid across the membrane.

Vrinda Sharma (3rd Year)

A Study of Bubble Size Evolution in Jameson Flotation Cell

The Sauter mean diameter (d32) of bubbles was characterized for a gas–liquid system in a laboratory Jameson-type flotation cell with focus on the size variation in the uprising path of the bubbles in the riser of the flotation cell. Methyl isobutyl carbinol (MIBC) was used as frother for bubble stability.

The effect of MIBC concentration, sampling height in the riser, gas flow rate (Jg) and liquid flow rate (Jl) in the downcomer on d32 was investigated. The d32 significantly decreased with increasing MIBC concentration until the Critical Coalescence Concentration (CCC), above which the d32 was almost constant at 0.645 mm. CCC95, CCC90 and CCC85 were calculated to be 0.059, 0.046 and 0.038 mmol/L, respectively for a Jg of 1.32 cm/s and Jl of 11 cm/s. Four frother concentrations covering these three values were selected for detailed studies. The size variation of bubbles was related to the Reynolds number (Re) in the downcomer, where the Re was influenced by Jl and Jg. Bubble size increased with the sampling height in the riser at MIBC concentrations below CCC95.

This bubble size decreased with the Re and, for all the MIBC concentrations used in this investigation, it reached a critical value, even at MIBC concentrations below the CCC85.

Priyanshi Agrawal (2nd Year)

Light Driven Reaction Converts Carbon Di Oxide into Fuels

Duke University researchers have developed tiny nanoparticles that help convert carbon dioxide into methane using only ultraviolet light as an energy source. Having found a catalyst that can do this important chemistry using ultraviolet light, the team now hopes to develop a version that would run on natural sunlight, a potential boon to alternative energy.

Chemists have long sought an efficient, light-driven catalyst to power this reaction, which could help reduce the growing levels of carbon dioxide in our atmosphere by converting it into methane, a key building block for many types of fuels. Not only are the rhodium nanoparticles made more efficient when illuminated by light, they have the advantage of strongly favoring the formation of methane rather than an equal mix of methane and undesirable side-products like carbon monoxide. This strong "selectivity" of the light-driven catalysis may also extend to other important chemical reactions, the researchers say. "The fact that you can use light to influence a specific reaction pathway is very exciting," said Jie Liu, the George B.

Geller professor of chemistry at Duke University. "This discovery will really advance the understanding of catalysis. "The paper appears online Feb. 23 in Nature Communications. Despite being one of the rarest elements on Earth, rhodium plays a surprisingly important role in our everyday lives. Small amounts of the silvery grey metal are used to speed up or "catalyze" a number of key industrial processes, including those that make drugs, detergents and nitrogen fertilizer, and they even play a major role breaking down toxic pollutants in the catalytic converters of our cars.Rhodium accelerates these reactions with an added boost of energy, which usually comes in the form of heat because it is easily produced and absorbed.

However, high temperatures also cause problems, like shortened catalyst lifetimes and the unwanted synthesis of undesired products.In the past two decades, scientists have explored new and useful ways that light can be used to add energy to bits of metal shrunk down to the nanoscale, a field called plasmonics."Effectively, plasmonic metal nanoparticles act like little antennas that absorb visible or ultraviolet light very efficiently and can do a number of things like generate strong electric fields," said Henry Everitt, an adjunct professor of physics at Duke and senior research scientist at the Army's Aviation and Missile RD&E Center at Redstone Arsenal, AL. "For the last few years there has been a recognition that this property might be applied to catalysis."Rhodiumnanocubes observed under a transmission electron microscope.

Credit: Xiao ZhangXiao Zhang, a graduate student in Jie Liu's lab, synthesized rhodium nanocubes that were the optimal size for absorbing near-ultraviolet light. He then placed small amounts of the charcoal-colored nanoparticles into a reaction chamber and passed mixtures of carbon dioxide and hydrogen through the powdery material.When Zhang heated the nanoparticles to 300 degrees Celsius, the reaction generated an equal mix of methane and carbon monoxide, a poisonous gas. When he turned off the heat and instead illuminated them with a high-powered ultraviolet LED lamp, Zhang was not only surprised to find that carbon dioxide and hydrogen reacted at room temperature, but that the reaction almost exclusively produced methane."We discovered that when we shine light on rhodium nanostructures, we can force the chemical reaction to go in one direction more than another," Everitt said. "So we get to choose how the reaction goes with light in a way that we can't do with heat."

This selectivity -- the ability to control the chemical reaction so that it generates the desired product with little or no side-products -- is an important factor in determining the cost and feasibility of industrial-scale reactions, Zhang says."If the reaction has only 50 percent selectivity, then the cost will be double what it would be if the selectively is nearly 100 percent," Zhang said. "And if the selectivity is very high, you can also save time and energy by not having to purify the product."Now the team plans to test whether their light-powered technique might drive other reactions that are currently catalyzed with heated rhodium metal. By tweaking the size of the rhodium nanoparticles, they also hope to develop a version of the catalyst that is powered by sunlight, creating a solar-powered reaction that could be integrated into renewable energy systems."Our discovery of the unique way light can efficiently,

Selectively influence catalysis came as a result of an on-going collaboration between experimentalists and theorists," Liu said. "Professor Weitao Yang's group in the Duke chemistry department provided critical theoretical insights that helped us understand what was happening. This sort of analysis can be applied to many important chemical reactions, and we have only just begun to explore this exciting new approach to catalysis."This research was supported by the National Science Foundation (CHE-1565657) and the Army Research Office (Award W911NF-15-1-0320). Additional support was provided by Duke University's Katherine Goodman Stern Fellowship, the National Defense Science & Engineering Graduate Fellowship (NDSEG) Program and the Center for the Computational Design of Functional Layered Materials, an Energy Frontier Research Center funded by the U.S. Department of Energy (DOE), Office of Science, Basic Energy Sciences (BES), under Award # DE-SC0012575.

Payodhi Chandak (3rd Year)

Fuel Cell

A fuel cell is an electrochemical cell that converts the chemical energy from a fuel into electricity through an electrochemical reaction of hydrogen fuel with oxygen or another oxidizing agent. Fuel cells are different from batteries in requiring a continuous source of fuel and oxygen (usually from air) to sustain the chemical reaction, whereas in a battery the chemical energy comes from chemicals already present in the battery. Fuel cells can produce electricity continuously for as long as fuel and oxygen are supplied.

The first fuel cells were invented in 1838. The first commercial use of fuel cells came more than a century later in NASA space programs to generate power for satellites and space capsules. Since then, fuel cells have been used in many other applications. Fuel cells are used for primary and backup power for commercial, industrial and residential buildings and in remote or inaccessible areas.

They are also used to power fuel cell vehicles, including forklifts, automobiles, buses, boats, There are many types of fuel cells, but they all consist of an anode, a cathode, and an electrolyte that allows positively charged hydrogen ions (protons) to move between the two sides of the fuel cell. At the anode a catalyst causes the fuel to undergo oxidation reactions that generate protons (positively charged hydrogen ions) and electrons. The protons flow from the anode to the cathode through the electrolyte after the reaction. At the same time, electrons are drawn from the anode to the cathode through an external circuit, producing direct current electricity.

At the cathode, another catalyst causes hydrogen ions, electrons, and oxygen to react, forming water. Fuel cells are classified by the type of electrolyte they use and by the difference in startup time

ranging from 1 second for proton exchange membrane fuel cells (PEM fuel cells, or PEMFC) to 10 minutes for solid oxide fuel cells (SOFC). Individual fuel cells produce relatively small electrical potentials, about 0.7 volts, so cells are "stacked", or placed in series, to create sufficient voltage to meet an application's requirements. In addition to electricity, fuel cells produce water, heat and, depending on the fuel source, very small amounts of nitrogen dioxide and other emissions. The energy efficiency of a fuel cell is generally between 40–60%; however, if waste heat is captured in a cogeneration scheme, efficiencies up to 85% can be obtained.

A fuel cell is a lot like a battery. It has two electrodes where the reactions take place and an electrolyte which carries the charged particles from one electrode to the other. In order for a fuel cell to work, it needs hydrogen (H_2) and oxygen (O_2). The hydrogen enters the fuel cell at the anode. A chemical reaction strips the hydrogen molecules of their electrons and the atoms become ionized to form H^+. The electrons travel through wires to provide a current to do work. The oxygen enters at the cathode, usually from the air. The oxygen picks up the electrons that have completed their circuit. The oxygen then combines with the ionized hydrogen atoms (H^+), and water (H_2O) is formed as the waste product which exits the fuel cell. The electrolyte plays an essential role as well. It only allows the appropriate ions to pass between the anode and cathode. If other ions were allowed to flow between the anode and cathode, the chemical reactions within the cell would be disrupted.

The reaction in a single fuel cell typically produces only about 0.7 volts. Therefore, fuel cells are usually stacked or connected in some way to form a fuel cell system that can be used in cars, generators, or other products that require power.The reactions involved in a fuel cell are as follows:

Anode side (an oxidation reaction): $2H_2 => 4H^+ + 4e^-$

Cathode side (a reduction reaction): $O_2 + 4H^+ + 4e^- => 2H_2O$

Net reaction (the "redox" reaction): $2H_2 + O_2 => 2H_2O$

The benefits of fuel cells are numerous. These benefits come more into reality as new markets for fuel cells arise. As of right now there are $218 million in the industry, and by 2004 there is expected to be an increase to $2.4 billion. By 2009, it is expected to climb to $7 billion (Breakthrough Technologies Institute/Fuel Cells 2000).

The burning of fossil fuels can be reduced by the use of fuel cells. If 20% of cars used fuel cells, oil imports would be cut by 1.5 million barrels/day. This would dramatically decrease U.S. dependence on the Middle East fuel source. This would save the U.S. millions of dollars. If 10,000 fuel cell vehicles alone were running on non-petroleum fuel, oil consumption would reduce by 6.98 million gallons/year. As oil consumption would be reduced, the air quality would become better, especially in urban areas. Along with this, 60 million tons of greenhouse gas would be eliminated. The main greenhouse gas is carbon dioxide, which is the waste product of burning fossil fuels. The waste from fuel cells is able to be consumed since it is merely water, a much safer by-product. Overall, the quality of life would become better as new technology is able to eliminate use of the limited supply of fossil fuels.

Sheikh Mohammed Zaid (3rd Year)

Role of Chemical Engineer In An Industry

Chemical engineers translate processes developed in the lab into practical applications for the commercial production of products and then work to maintain and improve those processes. The main role of chemical engineers is to design and troubleshoot processes for the production of chemicals, fuels, foods, pharmaceuticals, and biological, and many more. They are most often employed by large-scale manufacturing plants to maximize productivity and product quality while minimizing costs.

The aerospace, automotive, biomedical, electronic, environmental, medical, and military industries seek the skills of chemical engineers in order to help develop and improve their technical products.

Chemical engineers work in almost every industry and affect the production of almost every article manufactured on an industrial scale. Some typical tasks include:

1. Ensuring compliance with health, safety, and environmental regulations

2. Conducting research into improved manufacturing processes

3. Designing and planning equipment layout

4. Incorporating safety procedures for working with dangerous chemicals

Vishal Sharma (4th Year)

Sensors Used In Industries

Introduction:

A Sensor is a device that identifies the progressions in electrical or physical or other quantities and in a way to deliver a yield as an affirmation of progress in the quantity. In simple terms, Industrial Automation Sensors are input devices which provide an output (signal) with respect to a specific physical quantity (input).

Sensors used in Automation:

In the industrial automation, sensors play a vital part to make the products intellectual and exceptionally automatic. These permit one to detect, analyze, measure and process a variety of transformations like alteration in position, length, height, exterior and dislocation that occurs in the Industrial manufacture sites.

These sensors also play a pivotal role in predicting and preventing numerous potential proceedings, thus, catering to the requirements of many sensing applications.

The following are the various types of sensors used in automation:

- Temperature Sensors
- Pressure sensors
- MEMS Sensors
- Torque Sensors

- **Temperature Sensors :**

  A temperature sensor is a device that collects information concerning the temperature from a resource and changes it to a form that can be understood by another device.

- **Pressure Sensors:**

  The Pressure Sensor is an Instrument that apprehends pressure and changes it into an electric signal where the quantity depends upon the pressure applied.

- **MEMS Sensors (Micro-electro-mechanical Systems)**

  These MEMS industrial automation sensors convert measured mechanical signals into electrical signals.

  Acceleration and Motion MEMS are few important sensors used in industrial automation.

- **Torquesensors**

  The torque sensors complete with essential mechanical stops, raise overload capacity and offer additional guard during mounting and operation.

  Rotating Torque & Torque Transducers are few important sensors used in industrial automation.

Conclusion:

All these above mentioned sensors are increasingly utilized in the automation industry. The recent surge in commercial demonstration of these sensor systems highlights their unique capabilities.The Future of Artificial Intelligence in Manufacturing Industries

Rajdeep Singh (2nd Year)

The Future of Artificial Intelligence in Manufacturing Industries

Introduction:

For a large group of industries such as gaming, banking, retail, commercial, and government, etc. AI is extensively used and is slowly impending in the manufacturing sector, facilitating the industrial Automation. AI-driven machines are laying an easier path to the future by yielding a bunch of benefits – offering new opportunities, enhancing production efficiencies, and bringing machine interaction closer to human interaction.

AI facilitates to conquer many internal challenges that have been around in the industry: from expertise shortage to complexity in decision making, issues related to integration, and overloaded information. Making use of AI in manufacturing plants enables businesses to completely transform their proceedings. Let’s have a glance at how AI is helping the manufacturing sector to accomplish: Directed Automation,24X7 Production, Safer Operational Environment ,Novel Opportunities for Humans , Condensed operating costs.

The Affect AI in the Manufacturing Industry

The manufacturing industry has always been available to embrace the innovative technologies. Drones and industrial robots have been a part of the manufacturing industry since 1960’s. The following automation revolution is just around. With the implementation of AI, if organisations can keep inventories lean and reduce the cost, there is a high probability that the Manufacturing Industry will encounter an empowering development. Having said that, the manufacturing sector has to be prepared for organized manufacturing plants where supply chain, design team, production line, and quality control are very coordinated into an intelligent engine that provides noteworthy insights of knowledge.

Conclusion:

AI’s proponents claim that the technology is only an evolutionary form of automation. AI may be efficient at creating things, improving them, and making them cheaper. But there is no replacement for human ingenuity in dealing with the unanticipated changes in tastes and demands or in deciding whether to make things at all.

Raj Malviya (Ist Year)

The First Chemical Engineer

Industrial chemistry was being practiced in the mid-1800s, but it was not until the 1880s that the engineering elements required to control chemical processes were being recognized as a distinct professional activity. Chemical engineering was first established as a profession in the United Kingdom when the first chemical engineering course was given at the University of Manchester in 1887 by **George E. Davis** in the form of twelve lectures covering various aspects of industrial chemical practice.

As a consequence George E. Davis is regarded as the world's first chemical engineer. Today, chemical engineering is a highly regarded profession.

Chemical engineers with experience can become licensed Professional Engineers in the United States, aided by the National Society of Professional Engineers, or gain "Chartered" chemical-engineer status through the UK-based **Institution of Chemical Engineers.**

George Edward Davis is regarded as the founding father of the discipline of **Chemical Engineering.**

Davis was born at Eton on 27 July 1850, the eldest son of George Davis. He was a bookseller. At the age of fourteen he was apprenticed to a local bookbinder but he abandoned this trade after two years to pursue his interest in chemistry. Davis studied at the Slough Mechanics Institute while working at the local gas works, and then spent a year studying at the Royal School of Mines in London (now part of Imperial College, London) before leaving to work in the chemical industry around Manchester, which at the time was the main center of the chemical industry in the UK.

Davis worked as a chemist at Brearley and Sons for three years. He also worked as an inspector for the Alkali Act of 1863, a very

early piece of environmental legislation that required soda manufacturers to reduce the amount of gaseous hydrochloric acid released to the atmosphere from their factories. In 1872 he was engaged as manager at the Lichfield Chemical Company in Staffordshire. In this job his capacity for innovation flourished. His works included what was at the time the tallest chimney in the UK, with a height of more than 200 feet.

Davis was also instrumental in the formation of the Society of Chemical Industry (1881), which he had wanted to name the *Society of Chemical Engineering* and was its first Secretary.

Davis identified broad features in common to all chemical factories and wrote the influential *A Handbook of Chemical Engineering*. He also published a famous lecture series of 12 lectures, given in 1888 at Manchester Technical School (which became University of Manchester Institute of Science and Technology (UMIST)). These lectures defined **Chemical Engineering as a discipline.**

His lectures were criticized for being common place *know-how* since it was designed around operating practices used by British chemical industries. At this time, however, in the United States, this information helped initiate new thinking in the Chemical Industry, as well as spark Chemical Engineering degree programmes at several universities in the US. Now, the Chemical engineering degree is spread in all over the world. This branch has a wide scope and full of opportunities.

Rohit Kumar Singh (3rd Year)

Nanotechnology

The main thing to know about nanotechnology is that it's small. Really small. Nano, a prefix that means "dwarf" in Greek, is shorthand for nanometer, one-billionth of a meter: a distance so minute that comparing it to anything in the regular world is a bit of a joke. This comma, for instance, spans about half a million nanometers. To put it another way, a nanometer is the amount a man's beard grows in the time it takes him to lift a razor to his face.

Nanotechnology matters because familiar materials begin to develop odd properties when they're nanosize. Tear a piece of aluminum foil into tiny strips, and it will still behave like aluminum—even afer the strips have become so small that you need a microscope to see them. But keep chopping them smaller, and at some point—20 to 30 nanometers, in this case,—the pieces can explode. Not all nanosize materials change properties so usefully (there's talk of adding nano-aluminum to rocket fuel), but the fact that some do is a boon. With them, scientists can engineer a cornucopia of exotic new materials, such as plastic that conducts electricity and coatings that prevent iron from rusting. It's like you shrink a cat and keep shrinking it, and then at some point, all at once, it turns into a dog.

Substances behave magically at the nanoscale because that's where the essential properties of matter are determined. Arrange calcium carbonate molecules in a sawtooth pattern, for instance, and you get fragile, crumbly chalk. Stack the same molecules like bricks, and they help form the layers of the tough, iridescent shell of an abalone.

It's a tantalizing idea: creating a material with ideal properties by customizing its atomic structure. Scientists have already developed rarefied tools, such as the scanning tunneling microscope, capable of viewing and moving individual atoms via an exquisitely honed tip just one atom wide.

"Nano's going to be like the invention of plastic," says Paul Alivisatos, associate director of physical sciences at Lawrence Berkeley national Laboratory's new nanofabrication center. "It'll be everywhere: in the scalpels doctors use for surgery and in the fabrics we wear." Alivisatos already owns a pair of stain-resistant nanopants from the Gap, made from fibers treated with fluorinated nanopolymer. "I spilled coffee on them this morning, and it rolled right off."

On a table in a lab at Rice University, André Gobin, a graduate student, is working with two slices of raw chicken. He nudges the slices together so they touch and dribbles greenish liquid along the seam. The liquid is a solution of nanoshells: minuscule silica beads covered, in this case, with gold. Switching on an infrared laser, Gobin deftly traces the beam down the length of the green line. Tweezing the chicken up, he dangles what is now a single piece of meat.

Someday soon surgeons may be able to use a nanoshell treatment like this to reconnect veins that have been cut during surgery. "One of the hardest things a doctor has to do during a kidney or heart transplant is reattach cut arteries," says Gobin. "They have to sew the ends together with tiny stitches. Leaks are a big problem." With Gobin'snanoshell solution a surgeon could simply meld the two ends and get a perfect seal. It would make grafting veins as easy as soldering wire.

Although much of nanotechnology's promise remains unrealized, investment in the field is booming. The U.S. government allocated more than a billion dollars to nanotechnology research in 2005—more than twice what it spent on sequencing the human genome when that project was at its height. Japans and the European Union have spent similar amounts, and even smaller countries are hurrying to get a foot in the door. A Korean company has used nanosilver-based antibacterials in refrigerator interiors. The same material can be incorporated in bandages. The hopes is the same on all fronts: to get the jump on a growing global market that the National Science Foundation estimates will be worth a trillion dollars by 2015. One reason for the rapid global spread of nanotechnology is that the entry cost is comparatively low. Countries that missed out on the computer revolution because they lacked the capital to build vast, high-tech factories that make silicon chips are less likely to miss the nanotech wave.

"It's science you can do in a beaker," says Stephen Empedocles, vice president of Nanosys, a company that's developing cheap solar nanostructures. Traditionally the manufacture of solar-energy cells has required a multimillion-dollar fabrication facility that cooks sheets of glass at extremely high temperatures until the atoms order themselves into a receptive latticework. Solar nanostructures, on the other hand, grow like rock candy. You can "mix them up in a beaker with a hundred dollars' worth of starter chemicals," Empedocles says, and then paint them on window glass to turn an entire building into a solar-energy generator. Or, they might be embedded in the plastic body of a cell phone or a laptop computer.

Ashit Tiwari (Ist Year)

Biogas and Biofuel

Biogas is the gaseous emissions from anaerobic degradation of organic matter (from plants or animals) by a consortium of bacteria. Biogas is principally a mixture of methane (CH_4) and carbon dioxide (CO_2) along with other trace gases. Methane gas, the primary component of natural gas (98%), makes up 55-90% by volume of biogas, depending on the source of organic matter and conditions of degradation. Biogas is produced in all natural environments that have low levels of oxygen (O_2) and have degradable organic matter present. These natural sources of biogas include: aquatic sediments, wet soils, buried organic matter, animal and insect digestive tracts, and in the core of some trees. Man's activities create additional sources including landfills, waste lagoons, and waste storage structures. Atmospheric emissions of biogas from natural and man-made sources contribute to climate change due to methane's potent greenhouse gas properties. Biogas technology permits the recovery of biogas from anaerobic digestion of organic matter using sealed vessels, and makes the biogas available for use as fuel for direct heating, electrical generation or mechanical power and other uses. Biogas is often made from wastes but can be made from biomass energy feedstocks as well.

Biofuels to Electricity

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Ajay Mahato (3rd Year)

Biofuels

Biofuels have been around as long as cars have. At the start of the 20th century, Henry Ford planned to fuel his Model with ethanol, and early diesel engines were shown to run on peanut oil.

But discoveries of huge petroleum deposits kept gasoline and diesel cheap for decades, and biofuels were largely forgotten. However, with the recent rise in oil prices, along with growing concern about global warming caused by carbon dioxide emissions, biofuels have been regaining popularity.

Gasoline and diesel are actually ancient biofuels. But they are known as fossil fuels because they are made from decomposed plants and animals that have been buried in the ground for millions of years. Biofuels are similar, except that they're made from plants grown today.

Much of the gasoline in the United States is blended with a biofuel—ethanol. This is the same stuff as in alcoholic drinks, except that it's made from corn that has been heavily processed. There are various ways of making biofuels, but they generally use chemical reactions, fermentation, and heat to break down the starches, sugars, and other molecules in plants. The leftover products are then refined to produce a fuel that cars can use.

Countries around the world are using various kinds of biofuels. For decades, Brazil has turned sugarcane into ethanol, and some cars there can run on pure ethanol rather than as additive to fossil fuels. And biodiesel—a diesel-like fuel commonly made from palm oil—is generally available in Europe.

On the face of it, biofuels look like a great solution. Cars are a major source of atmospheric carbon dioxide, the main greenhouse gas that causes global warming. But since plants absorb carbon dioxide as they grow, crops grown for biofuels should suck up about as much carbon dioxide as comes out of the tailpipes of cars that burn these fuels. And unlike underground oil reserves, biofuels are a renewable resource since we can always grow more crops to turn into fuel.

Raj Malviya (I^st Year)