# ASSOCIATION OF CHEMISTRY TEACHERS

## NEWS LETTER

ISSUE : 23 MAY - AUGUST 2022

Promoting Excellence in Chemistry Education

# Association of Chemistry Teachers
## News Letter, May - August 2022

## Contents of the News Letter : Issue - 23

# From Editorial Desk

**Prof. Wasudeo Gurnule**
Editor
Kamla Nehru Mahavidyalaya,
Nagpur, Maharashtra.

We are happy to inform that the contributions of ACT ranges from International Olympiads, organizing seminars, science exhibitions, workshops, expert invited talks, innovating conceptual science experiments, conferences, talent search examinations, training faculty and students etc. We are bringing in the present issue of the newsletter with the reports on the ACT activities, trends in chemistry, views and news. We have included one scientificarticles in the present issue. We have also included reports on National Chemistry Events. We humbly request the entire fraternity of ACT to continue to contribute both in terms of their academic and individual achievements for the benefit of entire ACT Community.

We invite good suggestions and better contributions from the readers to get best output of the future issues. We welcome you all to participate in the third research convention.

## Members of Editorial Board

# Honorary Members of ACT

We have great pleasure in bringing the updated list of honorary members of Association of Chemistry Teachers, who are sources of inspiration, guidance and support in activities of ACT.

**The editorial board of ACT News Letter is proud of the academic achievements of these legendary honorary members.**

**Bharat Ratna Prof. C.N.R. Rao,** FRS
National Research Professor : Linus Pauling Research Professor,
Jawaharlal Nehru Centre for Advanced Scientific Research, Jakkur, Bengaluru –560 064
E–mail : cnrrao@jncasr.ac.in

**Padma Vibhushan Prof. M.M. Sharma,** FRS
Former Director, Institute of Chemical Technology, Mumbai –440 019.
2/3, Jaswant Baug, V.N. Purav Marg, Chembur, Mumbai –400 071
E–mail : profmmsharma@gmail.com

**Padma Vibhushan Dr. R.A. Mashelkar,** FRS
CSIR Bhatnagar Fellow;i Former Director General, CSIR, New Delhi.
President, Global Research Alliance, National Chemical Laboratory, Pune –411 008.

**Dr. Nitya Anand**
Former Director, CSIR–Central Drug Research Institute, Lucknow.
B–62, Nirala Nagar, Lucknow –226 020
E–mail : nityaanand1925@gmail.com

**Prof. R.S. Mali**
Former Vice–Chancellor, North Maharashtra University, Jalgaon.
B–2, Surajbun Housing Society, Aundh Road, Pune –411 007.
E–mail : rsmali@rediffmail.com

**Prof. S. Jayarama Reddy**
Former Vice–Chancellor, S.V. University, Tirupati; Chancellor, SCSSV Mahavidyalaya, Kanchi
201, Ameya Towers, Street No. 12, Tarnaka, Hyderabad –500 017.
E–mail : profsir@gmail.com

**Padma Shri Prof. Jai P. Mittal**
Former Director, Chemistry –Isotope Group, BARC, Mumbai –400 085.
Chairman, Academic Board, UM–DAE Centre for Excellence in Basic Sciences,
University of Mumbai, Kalina, Mumbai –400 098
E–mail : mittaljp2003@yahoo.co.in

**Prof. Mihir K. Chaudhuri**
Former Vice–Chancellor, Tezpur University, Tezpur.
Advisor, Education Department of Government of Assam, Gawahati –781 006
E–mail : chaudhurimihirk@gmail.com; mkc@tezu.ernet.in

## Spectrum of Activities of ACT

### Report of the One Day National Seminar on

# 'SUSTAINABLE DEVELOPMENT GOALS AND THEIR EVALUATION'

As we all know, the United Nations General Assembly has recently adopted a resolution proclaiming the year 2022 to be the International Year of Basic Sciences for Sustainable Development. In synchronization with this proclamation, Internal Quality Assurance Cell of Government General Degree College, Singur, Hooghly, West Bengal, India & Rani Rashmoni Green University, Tarakeswar, Hooghly, West Bengal, India in collaboration with Association of Chemistry Teachers (ACT), Mumbai, organised this One Day National Seminar with an objective to accelerate the collaboration among participants for sustainable research outcomes.

The idea of conducting such a seminar came to my mind while conversing with respected Prof. D. V. Prabhu Sir, General Secretary, ACT on 17th of March, 2022 through email. Even Prof. B. Pare Sir, President ACT also encouraged me to conduct such a seminar in our zone. He even shared a few details related to 'International Year of Basic Sciences for Sustainable Development [IYBSSD]' on 28th March, 2022.

I individually contacted Prof. Ashutosh Ghosh Sir, Honourable Vice–Chancellor of Rani Rashmoni Green University and Prof. Santanu Chakrabarti Sir, Principal, Government General Degree College –Singur, West Bengal to seek permission for conducting this seminar in a collaborative way involving Association of Chemistry Teachers (ACT), Government General Degree College, Singur and Rani Rashmoni Green University as I am attached with all these prestigious organizations in various capacities. Having received the consents from all of them, I made a request to Dr. Anindita Bhadra Madam [Associate Professor of Behaviour and Ecology Lab, Department of Biological Sciences, IISER Kolkata and Associate Dean of International Relations and Outreach, IISER Kolkata to be present amongst us as a resource person. In this aspect, it is worthwhile to mention that I came to know about Dr. Bhadra, nodal person for India for IYBSSD from Prof. B. Pare Sir in the EC meeting held on 9th April, 2022 at HBCSE, TIFR–Mumbai.

I also contacted Prof. Susanta Lahiri Sir, former Senior Professor and Ex-Head, Chemical Sciences Division, Saha Institute of Nuclear Physics, Kolkata to seek his permission as the resource person for this national event. Prof. Lahiri Sir is the Adjunct Professor of Physics in the Sidho-Kanho-Birsha University,

**Prof. Dr. Susanta Lahiri**
Sidho-Kanho-Birsha University
Ranchi Road, Purulia

**Dr. Anindita Bhadra**
Department of Biological Sciences,
IISER, Kolkata

**Dr. Swati Nandi Chakraborty**
Environment Scientist and Columnist

Purulia. He is also the Emeritus Scientist (CSIR) in the Department of Chemistry, Diamond Harbour Women's University. He is also the Guest Faculty in the Department of Chemistry, Rani Rashmoni Green University and in the Department of Chemistry, University of Calcutta. Professor Lahiri Sir is also associated intimately with Department of Environmental Sciences, University of Calcutta and Department of Archaeology, University of Calcutta. His **Major research interest**: Accelerator production of neutron deficient radionuclides; Radiotracer technique; Naturally Occurring Radioactive Materials (NORM); Converter targets; Super heavy elements, Accelerator Mass Spectrometry; Green Chemistry; Trace Analysis. I also contacted **Prof. Swati Nandi Chakraborty** Madam, an environmentalist and an eminent columnist to deliver a session in this seminar.

Faculty Development Programme

# On Green Chemistry for Sustainable Development

organized by

SRM Institute of Science and Technology,

Faculty of Engineering and Technology,

Department of Chemistry in Association with

Association of Chemistry Teachers (ACT),

Mumbai


# Activities of ACT

1. International Conference organized on Advanced Research Strategies for Sustainable Development on 3-4 June 2022 organized by Association of Chemistry Teachers(ACT) and Career College, Bhopal.

2. Faculty Development Programme on May 16-21,2022 by Prof. Helen Kavitha, Head, Department of Chemistry, at SRM Institute of Science and Technology, Ramapuram, Chennai.

3. National Seminar on Sustainable Development-goals and their evaluation on June 6,2022 by Prof Amrit Krishna Mitra, Head, Department of Chemistry, Government General Degree College, Sinur, Hooghly, West Bengal in association with Rani Rashmoni Green University, Tarakeswar, Hooghly, West Bengal.

4. National Conference on Current Trends in Chemical Sciences on June 28-29, 2022 by Prof. Anand Aswar, Head and Prof. Jagruti Barabde at Department of Chemistry, Sant Gadge Baba Amravati University, Amravati, Maharashtra.

5. International Web Workshop on "Learners' Alternative Conceptions –What the teacher should know and do" by Prof. Dr. Keith S. Taber, Emeritus Professor of Science Education, University of Cambridge and Senior Member, Homerton College, Cambridge , UK was organized on August 25, 2022 by ACT in association with Quantum Vault and UAE Sahodaya School Complex, UAE. A record 192 participants from India and abroad attended the web workshop. Prof. Brijesh Pare, President, ACT took the initiative to organize the workshop.

# Potential of Titanium Dioxide and its Applications

**Dr. Rashmi R. Dubey**
Department of Chemistry,
Kamla Nehru Mahavidyalaya,
Nagpur-440024,

Titanium dioxide is a naturally occurring substance, chemical formula $TiO_2$, known as titania. It is a common material that has been widely used for many years, naturally occurring titanium dioxide forms when titanium reacts with the oxygen in the air. Titanium dioxide is determined by minerals inside the earth's crust. It is likewise determined with different elements, which include calcium and iron. Commercially titanium dioxide was first introduced in 1923; no health concerns and no cases of problems have been detected associated with it. Recently shows that thousands of workers in the manufacturing industry or involved in titanium dioxide which was having no risk of cancer or have any adverse effects on respiratory systems. However, it was found that exposure to $TiO_2$ can affect the lungs of rats. Titanium dioxide is formed when titanium reacts with oxygen in the air. The forms of Titanium dioxide are shown in Table 1.

**Table 1:** Forms of titanium oxide

| Type | Crystal System |
|---|---|
| Rutile | Tetragonal |
| Anatase | Tetragonal |
| Brookite | Ortho-rhombic |
| Titanium Dioxide(B) | Monoclinic |
| Titanium dioxide(H) | Tetragonal |
| Titanium dioxide(R), Ramsdellite | Ortho-rhombic |
| Titanium dioxide(II)-(α-PbO2) | Ortho-rhombic |
| Akaogiite (baddeleyite) | Mono-clinic |
| Titanium dioxide-OI | Ortho-rhombic |
| Cubic Form | Cubic |
| $TiO_2$ -OII | Ortho-rhombic |

Titanium dioxide has 8 modifications‒similarly to rutile, anatase, akaogiite, and brookite, 3 metastable stages may be produced synthetically (monoclinic, tetragonal, and orthorhombic), and 5 high‒strain forms ($\alpha$-$PbO_2$‒like, baddeleyite‒like, cotunnite‒like, orthorhombic, and cubic stages) additionally exist: Titanium is particularly sourced from ilmenite ore; it's the most sizable form of titanium dioxide‒bearing ore throughout the world. Rutile is the following most large and includes spherical 98% titanium dioxide inside the ore. Metastable anatase and brookite degrees convert to the equilibrium rutile segment irreversibly on heating above temperatures with inside the variety of 600 to 800°C (1,112 to 1,472°F).

## Applications of Titanium dioxide

$TiO_2$ is a white shade located in all types of paints, printing ink, plastics, paper, synthetic fibers, rubber, condensers, painting colors and crayons, ceramics, virtual components on the aspect of food, and cosmetics. NPS of titanium dioxide has been stated useful inside the place of photodynamic treatment for drug delivery at the specific site. The uses of Titanium dioxide are represented in Fig. 2. Titanium dioxides ($TiO_2$) have been extensively studied, due to their thrilling famous houses in an in‒depth style of fields such as catalysis, photocatalysis, and antibacterial agents, and in civil as nano‒paint (self‒cleaning) which have an impact at the brilliant of life.

When used as a pigment, it's far called titanium white, Pigment White 6, or CI 77891. The great efforts committed to the research on $TiO_2$ cloth produced many promising uses in areas that range from photovoltaics and photo‒catalysis to photo‒electrochromic and sensors. These make use of may be commonly labeled into "energy" and "environmental" kinds, many kinds depend now no longer simplest at the homes of the $TiO_2$ fabric itself however additionally at the modifications with inside the $TiO_2$ fabric host. Titanium dioxide single‒crystal can also be studied under Independence spectroscopy photoelectron spectroscopy and Kelvin probe measurement which shows that the Fermi level and conduction band depend on the sample environment. Titanium dioxide has been using of as a bleaching and opacifying agent in porcelain enamels it offers brightness, hardness, and acid resistance.it is also used in cosmetics that charge in screen lotions, skincare products, as a UV protector because it's property to absorb UV light. The color and brightness of food products $TiO_2$ are enhanced by using $TiO_2$. It is also used as a white pigment in toothpaste. $TiO_2$ nanostructure has been employed in photo electrochemical bio‒sensing applications which enhances detection of the target. These are brilliant addictive substances for titanium implants deficiencies and use coating for the wherein the floor of titanium implants.

Titanium dioxide NPS can be very vital as that particle has quality used in new clinical therapies. The software of heat Titanium NPS in photodynamic treatment is constrained thru manner way of them wants to apply UV moderate of very low tissue sanitation and perilous effect on the human body. $TiO_2$ pigments have many vital homes like scattering power, brightness, hiding power, mass tone, gloss formation, gloss haze, dispensability, light fastness, and weather resistance; the one's homes are a function of chemical purity, lattice stabilization, primary particle period, particle period distribution, and the coating. Theoretically, the scale of TiO debris is between 0.2 and 0. 3 µm, but due to the formation of agglomerates the pigments have a considerably huge period, the ones agglomerates influences hiding power, tinting energy, and distinctive end-use homes of the coating.

$TiO_2$ is currently used inside the biocompatibility of bone implants and an insulator in MOSFETS $TiO_2$ nanostructures are used for coatings of the naked floor of titanium implants, which might be terrific addictive substances to recompense titanium implants deficiencies-like bad floor interplay with surrounding tissues-through supplying nano-porous surfaces and hierarchical structures. In the floor technological know-how of steel oxides, titanium dioxide ($TiO_2$) is the maximum studied crystalline oxide. Its bodily and chemical residences are dominantly decided through its floor condition. $Ti^{3+}$ floor defect (TSD) is one of the maximum vital floor defects in $TiO_2$.

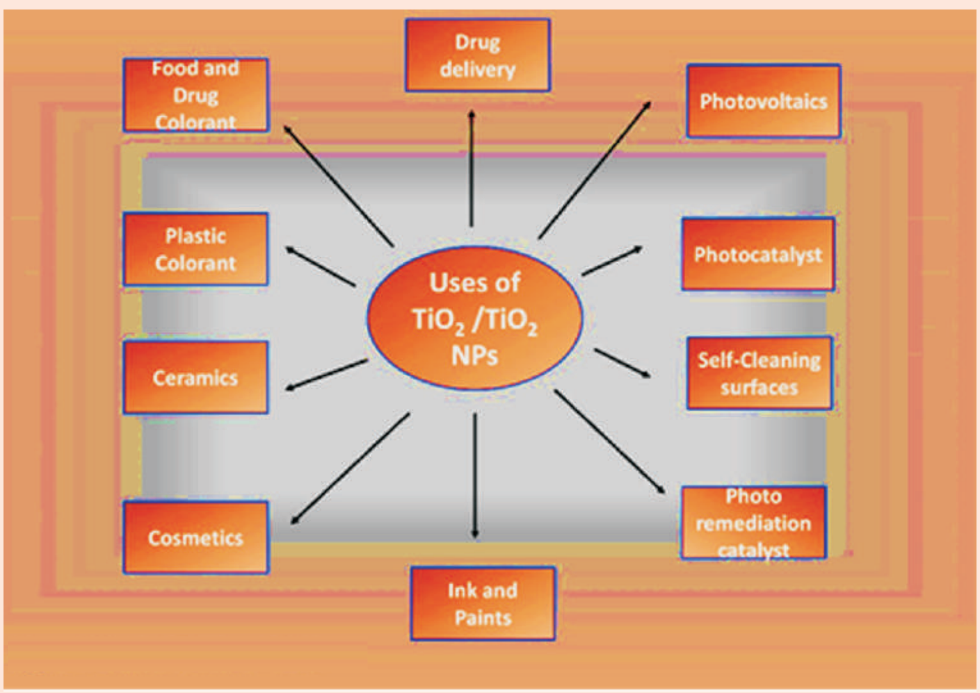



Figure 1 : Uses of Titanium Oxide

Titanium dioxide ($TiO_2$) photo–catalysis is an oxidation approach that has determined extensive use in self–cleansing substances and water purification, in which the overall intention is to mineralize and detoxify the natural pollutants. $TiO_2$ photo–catalysis can generate the equal reactive oxygen species as inorganic systems, specifically hydroxyl radicals (OH) and superoxide anions ($O_2^-$)UV mild with better strength than that of the bandgap of $TiO_2$ excites electrons to the conduction band beneath $TiO_2$ photo–catalysis, which leaves holes at the valence band. The electrons at the conduction band can lessen molecular oxygen to superoxide. Hydroxyl radicals formed in reactions of valence band holes with water. A hollow also can receive an electron at once from a natural molecule adsorbed onto the $TiO_2$ surface. Degradation of carbamazepine takes place through UVC–assisted Nd–doped $Sb_2O_3/TiO_2$ photo–catalyst.

$TiO_2$ become used as a photo–catalyst in photocatalytic degradation of atenolol (ATL) which become investigated in aqueous suspensions using. Degradation of 37.6 μM ATL end up acquired after 60 min irradiation in pH 6, 8 Milli-Q water inside the presence of two 0 g $L^{-1}$ Degussa P25 $TiO_2$. The fee of the photo–catalytic oxidation of cyanide in aqueous $TiO_2$ suspensions (1–5 $gml^{-1}$) end up investigated as a feature of catalyst loading air–waft fee (zero. $2^{-1}$.1 l $min^{-1}$), and the attention of ethylene–diamine–tetraacetate, EDTA (zero. 4–forty mM) at pH 13 zero. The cyanide oxidation price did now no longer range with the $TiO_2$ loading whilst a mild growth with inside the degradation price with growth with inside the air–float price become determined. $TiO_2$ NPs discovered appealing ability as photocatalysts for anti–inflammatory, analgesic drugs. In addition, $TiO_2$–lined glass slides had been carried out for observation of a whole lot of oxidation reactions, such as drug applicants and their oxidation products.

The aggregate of the electroporation and the conjugation of the $TiO_2$ nanoparticles with the monoclonal antibody improves the photo killing selectivity and performance of photo–excited $TiO_2$ on most cancers cells inside the photodynamic therapy (PDT) because the conjugation of the $TiO_2$ nanoparticles with monoclonal antibodies will increase the photo killing selectivity of TiO2 nanoparticles to most cancers cells and the electroporation may want to boost up the shipping pace of the $TiO_2$ nanoparticles to most cancers cells. Analogous research on the usage of even better doses of $TiO_2$ gave comparable effects confirming that orally administered $TiO_2$ does now no longer penetrates the gastrointestinal tract and that penetration is medically insignificant. Iron (III) doping of $TiO_2$ NPS has been synthesized from the unknown catalytic function of Iron (III) nano hydrated (Fe $(NO_3)_3.9H_2O$) and $TiO_2$ with inside the ratio 1:1 those powders are handled hydrothermally. These Fe–doped $TiO_2$

NPs have such a lot of programs in photovoltaic and photocatalytic in new technologies.

Study on $TiO_2$ NPS penetration on Franz mobileular for twenty–four hours the usage of intact and needle aborted human pores and skin in addition to assessment cytotoxicity on HacaT keratinocytes, it becomes tested that the presence of $TiO_2$ NPs become coronavirus restrained to the epidermal layer, and the awareness of dermal layer become underneath the detection limit. Due to the high use of nanoparticles, it is of great interest to study the health effect caused due to exposure of nanomaterials. Gerard vales *et al.* experimented on human bronchial epithelium cell and BEAS–2B cell using chronic exposure, experiment showing no genotoxic effect in the comment and MN assay. Safety measures are essential as new nanoparticles enter the market and their relative toxicities are scarce, as this may be in the head by workers while working in paint industries and $TiO_2$ to NPS have an allergic reaction in by Vandebraj *et al.*. Continuous exposure to $TiO_2$ leads to chronic inflammation which is responsible for the destruction of body tissues leads to other diseases.

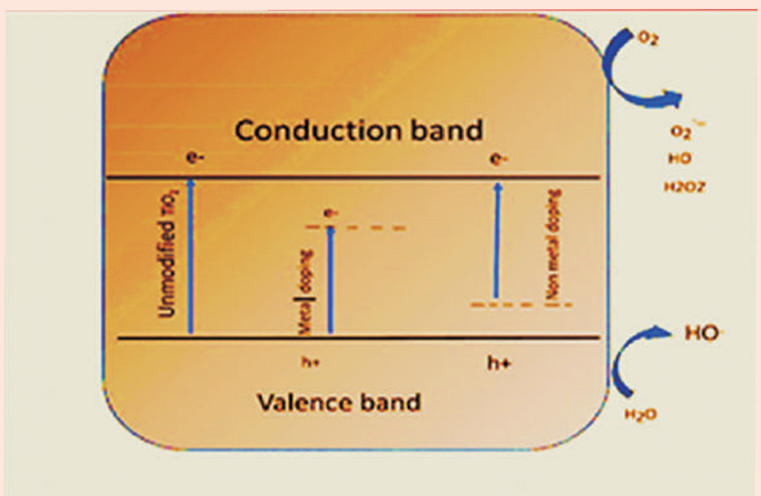



**Figure 2 : Mechanism of reactive oxygen species generation by TiO2**

Free oxygen might also additionally assault surrounding $O_2$ and $H_2O$ to shape Arrow ROS, such as superoxide's ($O_2^-$), hydrogen peroxide ($H_2O$), and hydroxyl radical (OH). $TiO_2$ NPS inhibits efflux multidrug resistance. Titania NPS forms agglomerates due to its nature which decreases the surface area and also lowers photo activity, sedimentation of $TiO_2$ NPs lowers concentration and interferes with the reproducibility of the result so to prevent this unexpected property stable formulation NPS is essential. The mechanism of reactive oxygen species generation by $TiO_2$ is shown in Fig. 3. The applications of selected $TiO_2$ nanoparticles (NPs) combined with photosensitizers in medicine are shown in Table 2.

**Table 2.** Applications of selected $TiO_2$ nanoparticles (NPs) combined with photosensitizers in medicine.

| Sr. No. | Shapes of NPS | Method of Synthesis | Photosensitizer | Uses |
|---|---|---|---|---|
| 1 | Anatase | phthalocyanine derivative | $TiCl_4$ and benzyl alcohol; macrocycle deposition overnight in THF | Clinical trial vs S. aureus, E. coli |
| 2 | Anatase | Zinc (II) – phthalocyanine | From TiCl4 and benzyl alcohol; macrocycle deposition overnight in THF | Clinical trial |
| 3 | Anatase (25 nm) | Zinc (II) 3–dodecylpyridyloxy phthalocyanine | Deposition in pyridine/ ethanol mixture | trial MRSA, Salmonella enteritidis |
| 4 | Rutile (thickness–600 nm , size–100 nm) | Copper tetracarboxy phthalocyanines (mixture of isomers) | Anodization | Activity vs. MRSA |
| 5 | P25 $TiO_2$ (75% ) | 5,10,15,20–tetrakis (2,6–difluorosulfonylophenyl) porphyrin and its zinc(II) complex | Commercial distribution | Activity against S. aureus, E. coli |
| 6 | N–$TiO_2$ –$NH_2$ (size: 20–30 nm) | Aluminum (III) phthalocyanine chloride tetrasulfonate | N–doping by calcination of commercially available anatase $TiO_2$ NPs in ammonia atmosphere | Photodynamic theory against cancer (HeLa and KB cell lines) |
| 7 | $TiO_2$ –$NH_2$ | Aluminum (III) phthalocyanine chloride | N–doping by calcination of commercially available anatase $TiO_2$ NPs in ammonia atmosphere | In photodynamic therapy of cancer |
| 8 | $TiO_2$ Nanowhiskers (< 100 nm) | Tetrasulphonatophenyl porphyrin | Undefined deposition in H2O | In photodynamic therapy of rheumatoid |
| 9 | $TiO_2$ Nanowhiskers | Tetrasulphonatophenyl porphyrin | Undefined; deposition in H2O | In photodynamic therapy of diabetes mellitus |
| 10 | P25 Titanium dioxide (75% anatase and 25% rutile, size–21 nm) | Chlorine 6 | Silylation with or without PEgylation | In photodynamic therapy vs. glioblastoma cell |
| 11 | $TiO_2$ (100 nm) | methylene blue used in mixture | commercial distribution | Activity against: S. aureus, E. coli, and Candida albicans |

Titanium has big software in medical, sun molecular photodynamic remedy cosmetics acceptor due to its outstanding photochemical homes and biocompatibility. This debris has low value and is without problems usable. The quantity of energetic websites on the floor decides on the photosensitization belongings and production value. $TiO_2$ nano micro particles are broadly utilized in photodynamic remedy $TiO_2$ has an event as a drug service with none dangerous impact at the fitness issue, $TiO_2$ NPS is used for such a lot of diseases. $TiO_2$ has a whole lot of software in meals and drugs, colorant, ink, and paints, cosmetics sunscreen additives batteries, etc. No facts are to be had for $TiO_2$ toxicity; however, it's miles essential to expand this region extensively.

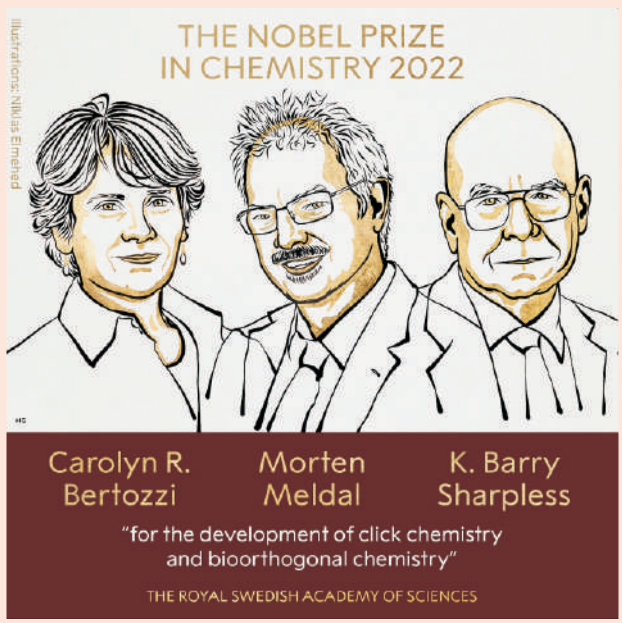
# Academic Participation of ACT Members

1. Prof Mannam Krishnamurthy, Secretary of ACT, South Zone, delivered a talk on Broadband Benchtop NMR Spectroscopy: It's more than just protonsy, in Chemistry World Webinar, on 29th June 2022.

2. Prof. Wasudeo Gurnule, Secretary of ACT West Zone, delivered a talk on Nanomaterials: A Green Approach for Sustainable Development, in Faculty Development Programme organized by Department of Chemistry, Faculty of Engineering and Technology, SRM Institute of Technology, Chennai in association with ACT Mumbai , on 17th May 2022.

## News, Views and More

# The Nobel Prize 2022 in Chemistry




The Royal Swedish Academy of Sciences has decided to award the Nobel Prize in Chemistry to

**Carolyn R. Bertozzi**
Stanford University, CA, USA

**Morten Meldal**
University of Copenhagen, Denmark

**K. Barry Sharpless**
Scripps Research, La Jolla, CA, USA

*for the development of click chemistry and bioorthogonal chemistry*

Barry Sharpless and Morten Meldal have laid the foundation for a functional form of chemistry – *click chemistry* – in which molecular building blocks snap together quickly and efficiently. Carolyn Bertozzi has taken click chemistry to a new dimension and started utilising it in living organisms.Chemists have long been driven by the desire to build increasingly complicated molecules. In pharmaceutical research, this has often involved artificially recreating natural molecules with medicinal properties. This has led to many admirable molecular constructions, but these are generally time consuming and very expensive to produce.

"This year's Prize in Chemistry deals with not overcomplicating matters, instead working with what is easy and simple. Functional molecules can be built even by taking a straightforward route," says Johan Åqvist, Chair of the Nobel Committee for Chemistry.

**Barry Sharpless** – who is now being awarded his second Nobel Prize in Chemistry – started the ball rolling. Around the year 2000, he coined the concept of click chemistry, which is a form of simple and reliable chemistry, where reactions occur quickly and unwanted by-products are avoided.

Shortly afterwards, **Morten Meldal** and Barry Sharpless – independently of each other – presented what is now the crown jewel of click chemistry: *the copper catalysedazide-alkyne cycloaddition*. This is an elegant and efficient chemical reaction that is now in widespread use. Among many other uses, it is utilised in the development of pharmaceuticals, for mapping DNA and creating materials that are more fit for purpose.

**Carolyn Bertozzi** took click chemistry to a new level. To map important but elusive biomolecules on the surface of cells – glycans – she developed click reactions that work inside living organisms. Her *bioorthogonal reactions* take place without disrupting the normal chemistry of the cell.

These reactions are now used globally to explore cells and track biological processes. Using bioorthogonal reactions, researchers have improved the targeting of cancer pharmaceuticals, which are now being tested in clinical trials.Click chemistry and bioorthogonal reactions have taken chemistry into the era of functionalism. This is bringing the greatest benefit to humankind.

# Novel Membranes can Remove Salt from Water.

A team led by **King Abdullah University of Science & Technology (KAUST)** has shown how ultrathin polymer-based ordered membranes can efficiently remove salt from brine and seawater, offering a potential alternative for current desalination systems.

"Water desalination membranes should simultaneously exhibit high water flux and high salt rejection," says Yu Han, who led the study. Carbon nanomaterials, such as carbon nanotubes and graphene, are projected to match these requirements because of their unique surface chemistry and tendency to stack into channels with diameters less than one nanometer. However, the challenges of channel alignment and stacking prevent their large-scale use in membranes.

"One way to address these limitations is through two-dimensional porous carbonaceous membranes with regular and uniformly distributed subnanometer-sized molecular transport channels," says first author JieShen, a postdoc in Han's group. However, these membranes are typically synthesized in solution, which promotes the random growth of a disordered three-dimensional structure with poorly defined micropores.

Using chemical vapor deposition, Yu Han, Vincent Tung, Ingo Pinnau, and Lance Li, a former researcher at KAUST who is now affiliated with the University of Hong Kong, have developed a technique that helps control the growth of two-dimensional conjugated polymer frameworks into ultrathin carbon films.

The researchers deposited the monomer triethynylbenzene on atomically flat single-crystalline copper substrates in the presence of an organic base that acts as a catalyst. Triethynylbenzene bears three reactive groups that serve as anchor points for additional monomers. These groups show a 120-degree angle with respect to each other, generating organized arrays of well-defined cyclic structures that stack into subnanometer-sized rhombic hydrophobic channels.

The membrane displayed excellent water desalination performance in forward and reverse osmosis configurations, surpassing those containing advanced materials such as carbon nanotubes and graphene. It also showed strong rejection for divalent ions, as well as small charged and neutral molecules.

The team is now working on improving the antifouling property, mechanical strength, and long-term chemical stability of the membrane for future practical applications. They are also fine-tuning its surface-charge properties and channel sizes. “Our ultimate goal is to provide a versatile multifunctional platform that meets the needs of various applications, such as ion sieving, single-molecule sensing, and neural interfaces,” Han says.

# Scientists Observed Conventional Superconductivity at Minus 70 Degrees Celsius

Up until now, no material has been able to conduct current with no resistance at such high temperatures: Researchers at the Max Planck Institute for Chemistry in Mainz and the Johannes Gutenberg University Mainz observed that hydrogen sulfide becomes superconductive at minus 70 degree Celsius—when the substance is placed under a pressure of 1.5 million bar. This corresponds to half of the pressure of the earth's core. With their high pressure experiments the researchers in Mainz have thus not only set a new record for superconductivity—their findings have also highlighted a potential new way to transport current at room temperature with no loss.

For many solid-state physicists, superconductors that are suitable for use at room temperature are still a dream. Up until now, the only materials known to conduct current with no electrical resistance and thus no loss did so only at very low temperatures. Accordingly, special copper ceramics (cuprates) took the leading positions in terms of transition temperature—the temperature at which the material loses its resistance. The record for a ceramic of this type is roughly minus 140 degrees Celsius at normal air pressure and minus 109 degrees Celsius at high pressure. In the ceramics, a special, unconventional form of superconductivity occurs. For conventional superconductivity, temperatures of at least minus 234 degrees Celsius have so far been necessary.

A team led by MikhaelEremets, head of a working group at the Max Planck Institute for Chemistry, working in collaboration with the researchers at Johannes Gutenberg University Mainz has now observed conventional superconductivity at minus 70 degrees Celsius, in hydrogen sulfide (H2S). To convert the substance, which is a gas under normal conditions, into a superconductor the scientists did however have to subject it to a pressure of 1.5 megabar (1.5 million bar), as they describe in the latest edition of the science magazine Nature.With our experiments we have set a new record for the temperature at which a material becomes superconductive," says MikhaelEremets. His team has also been the first to prove in an experiment that there are conventional superconductors with a high transition temperature. Theoretical calculations had already predicted this for certain substances including H2S. "There is a lot of potential in looking for other materials in which conventional superconductivity occurs at high temperatures," says the physicist. "There is theoretically no limit for the transition temperature of conventional superconductors, and our experiments give reason to hope that superconductivity can even occur at room temperature."

The researchers generated the extremely high pressure required to make H2S superconductive at comparatively moderate negative temperatures in a special pressure chamber smaller than one cubic centimeter in size. The two diamond tips on the side, which act as anvils, are able to constantly increase the pressure that the sample is subjected to. The cell is equipped with contacts to measure the electrical resistance of the sample. In another high–pressure cell, the researchers were able to investigate the magnetic properties of a material that also change at the transition temperature.After the researchers had filled the pressure chamber with liquid hydrogen sulfide, they increased the pressure acting on the sample gradually up to roughly two megabar and changing the temperature for each pressure level. They took measurements of both resistance and magnetization to determine the material's transition temperature. The magnetization measurements provide very useful information,because a superconductor possesses ideal magnetic properties.

MikhaelEremets and his team are now looking for materials with even higher transition temperatures. Increasing the pressure acting on the hydrogen sulfide above 1.5 megabar is not helpful in this case. This has not only been calculated by theoretical physicists, but now also confirmed in experiments performed by the team in Mainz. At even higher temperatures the electron structure changes in such a way that the transition temperature slowly begins to drop again.

## Wanted: hydrogen-rich materials with a higher transition temperature

"An obvious candidate for a high transition temperature is pure hydrogen," says Mikhael Eremets. "It is expected that it would become superconductive at room temperature under high pressure." His team has already begun experimenting with pure hydrogen, but the experiments are very difficult as pressures of three to four megabar are required.

Our research into hydrogen sulfide has however shown that many hydrogen–rich materials can have a high transition temperature," says Eremets. It may even be possible to realize a high–temperature superconductor worth the name in terms of common temperature perception without high pressure. The researchers in Mainz currently need the high pressure to convert materials that act electrically insulating like hydrogen sulfide into metals. "There may be polymers or other hydrogen–rich compounds that can be converted to metals in some other way and become superconductive at room temperature," says the physicist. If such materials can be found, we would finally have them: superconductors that can be used for a wide range of technical applications.

## List of ACT Life Members During May to August 2022

| Sr. No. | Names | LM No. | Institution |
|---|---|---|---|
| 1 | Dr. Rashmi Nair | 2419 | S. S. Jain Subodh P.G. College, Rambagh Circle, Jaipur –Rajasthan –302 004 |
| 2 | Dr. Neeru Gakkhar | 2420 | S.S. Jain Subodh P.G. College, Rambagh Circle, Jaipur, Rajasthan –302 004 |
| 3 | Dr. Sarabjot Kaur Makkad | 2421 | Govt. Autonomous NPG College of Science Raipur CG |
| 4 | Dr. Ravi Prakash | 2422 | Dept. of Chemistry, B.S.A.College, Mathura (UP) 281 004 |
| 5 | Dr. Ritu Rani Chaudhary | 2423 | Chemistry Department B.S.A. College, Mathura (UP) 281 004 |
| 6 | Dr. Penke Vijayababu | 2424 | Curia India Pvt. Ltd.(R&D),G1/1, Near MIDC Water Tank, Waluj, Aurangabad, Maharashtra, India –431136 |
| 7 | Dipalee Dileep Malkhede | 2425 | Department of Chemistry, Savitribai Phule Pune University Pune –411 007 |
| 8 | Dr. Kavita Sharma | 2426 | Dept. of Chemistry, Shri Vaishnav Vidyapeeth Vishwa Vidyalaya, Indore |
| 9 | Dr. V. Priya | 2427 | Dept. of Chemistry, Holy Cross College (Autonomous), Tiruchirappalli TN –620 002 |
| 10 | Dr. S. N. Karthick | 2428 | Assistant Professor, Department of Chemistry, Bharathiar University, Coimbatore, Tamilnadu, India –641 046 |
| 11 | Sarita Kalakoti | 2429 | Department of Chemistry, L.S.M. Govt. P.G. Collage, Pithoragarh, Distt. Pithoragarh –262 502 |
| 12 | Dr. Devjani Adhikari | 2430 | Department of Chemistry, L.S.M.Govt. P. G. College, Pithoragarh, Distt. Pithoragarh, Uttarakhand –262 502 |
| 13 | Chandrakal Singh | 2431 | Department of Chemistry, L.S.M.Govt.PG College, Pithoragard, Distt. Pithoragarh, Uttarakhand –262 502 |
| 14 | Kiran Kumar | 2432 | Mody University of Science & Technology, Laxmangarh (Sikar), Rajasthan –332 311 |
| 15 | Prachi | 2433 | Mody University of Science & Technology, Laxmangarh, Sikar –332 311 |

## List of ACT Life Members During May to August 2022

| Sr. No. | Names | LM No. | Institution |
|---|---|---|---|
| 16 | Manisha Rukela | 24234 | Mody University, Laxmangarh,<br>Sikar –332 311 |
| 17 | Dr. Sonam Mandani | 2435 | – |
| 18 | Kailash Chouhan | 2436 | Govt. P.G. (Lead) College,<br>Khargone (M.P.) –451 335 |
| 19 | Pushpanjali Sharma | 2437 | Acropolis Institite, Near Gopur Police Chouki,<br>Indore –M.P. –452 009 |
| 20 | Khushboo Mandawara | 22438 | Rajiv Gandhi Govt. College<br>Mandsour (M.P.) –458 001 |
| 21 | Sayma Parveen | 2439 | Rajiv Gandhi Govt. College,<br>Mandsaur (M.P.) –458 001 |
| 22 | Dr. Rakesh Choure | 2440 | Department of Chemistry, Govt.SSP College,<br>Waraseoni, Bobghat (M.P.) –481 331 |
| 23 | Dr. Veer Singh Barde | 2441 | Govt. College Bhabra,<br>Dist.–Alirajpure (M.P.) –451 770 |
| 24 | Ravin Chouhan | 2442 | Govt. Degree College Nainpur<br>Dist. Mandla (M.P.) –481 776 |
| 25 | Bhavsingh Dawar | 2443 | Rani Durgawati Govt.PG College,<br>Mandla (M.P.) 481 661 |
| 26 | Dr. Deepa Janardanan | 2444 | Department of Chemistry,<br>Central University of Kerala, Tejaswini Hills<br>(PO) Periya, Kasaragod, Kerala –671 320 |
| 27 | Dr. Gaurangi Gogoi | 2445 | Department of Chemistry,<br>PUB Kamrup College, Baihata Chariali,<br>Kamrup, Assam –781 381 |
| 28 | Dr. Bini George | 2446 | Department of Chemistry,<br>Central University of Kerala, Periye –671 315 |
| 29 | Dr. M. R. Ezhilarasi | 2447 | Department of Chemistry,<br>Karpagam Academy of Higher Education,<br>Coimbatore –641 021. |
| 30 | Dr. Anil B. Naik | 2448 | Department of Chemical Technology,<br>Sant Gadge Baba Amravati University,<br>Amravati (MS) India |

## List of ACT Life Members During May to August 2022

| Sr. No. | Names | LM No. | Institution |
|---|---|---|---|
| 31 | Narendra Bapuraoji Selukar | 2449 | Department of Chemical Technology, SGB Amravati University –444 602 |
| 32 | Dr. Biraj Das | 2450 | D.D.R. Collage, Chabua, Dibrugarh, Assam –786 184 |
| 33 | Dr. Eramoni Saikia | 2451 | D.D.R. College, Chabua, Dibrugarh, Assam –786 184 |
| 34 | Dr. Bitupon Borthakur | 2452 | Department of Chemistry, D.D.R. College, Chabva, Dibrugarh, Assam –786 184 |
| 35 | Dr. Rajesh Ram | 2453 | Deptartment of Chemistry, B.S.N.V., P.G. College, Lacknow –226 001 |
| 36 | Dr. Mamta Verma | 2454 | Navyug Kanya Mahavidyalaya, Rajendra Nagar, Lucknow |
| 37 | Dr. Vijay Shankar | 2455 | B.S.N.V.P.G. College, Lucknow –226 002 |
| 38 | Dr. Devendra Kumar | 2456 | Department of Chemistry, BSNVPG college, Lucknow –226 001 |
| 39 | Karina Milagros r. CUI–LIM | 2457 | University Town, Catarman, Northern Samar, Philippines |
| 40 | Dr. G. Kalaiarasi | 2458 | Department of Chemistry, Karpagam Academy of Higher Education, Coimbatore –641 021 |
| 41 | Dr. C. Rajasekhar Reddy | 2459 | Aditya College of Engineering & Technology, ADB Road, Surampalam –533 437 |
| 42 | Mr. N.V.V.D. Prasad | 2460 | Aditya College of Engineering, ADB Road, Surampalam –533 437 |
| 43 | Dr. Muralasetti Nookaraju | 2461 | Aditya College of Engineering & Technology ADB Road, Surampalem –533 437 |
| 44 | Sushama Sukhdev Kadam | 2462 | Hon. Balasaheb Jadhav Arts, Commerce & Scoemce College, Ale. Tal–Junnar, Dist.–Pune –412 411 |
| 45 | Vikas Mahadu Punde | 2463 | Hon. Balasaheb Jadhav Arts, Commerce and Science College, Ale. Tal : Junnar, Dist. –Pune –412 411 |

## List of ACT Life Members During May to August 2022

| Sr. No. | Names | LM No. | Institution |
|---|---|---|---|
| 46 | Dr. Tahmeena Khan | 2464 | Integral University, Kursi Road, Lucknow –226 026 |
| 47 | Daraksha Banu | 2465 | Integral University, Lucknow –226 026 |
| 48 | Manpreet Singh | 2466 | Lab No.301, New Building, CSIR–Central Salt & Marine Chemicals Research Institute, Shree Gijubhai Badheka Rd.Takhteshwar, Vidhyanagar, Bhavnagar, Gujrat –364 002 |
| 49 | Dr. Bhavesh Parmar | 2467 | Lab No. 106, New Building, CSIR–Central Salt & Marine Chemicals Research Institute, Shree Gijubhai Badheka Rd.Takhteshwar, Vidhyanagar, Bhavnagar, Gujrat –364 002 |
| 50 | Prajina O.K. | 2468 | Department of Chemistry, Saintgits College of Engineering, Kottayam, Kerala –686 532 |
| 51 | Siju N. Antony | 2469 | Saintgits College of Engineering, Pathamuttom P.O. Kottayam District, Kerala |
| 52 | Mini Koriakose | 2470 | Department of Chemistry, Saintgits college of Engineering –686 539 |
| 53 | Sonia Das | 2471 | Department of Chemistry, Saintgits College of Engineering, Kottayam, Kerala –686 532 |
| 54 | Dr. Ruchi Singh | 2472 | IIS (Deemed to be University), Jaipur –302020, Rajasthan |
| 55 | Dr. Deepak Singh Rajawat | 2473 | Department of Chemistry, IIS (Deemed to be University), Mansarowar, Jaipur –302020 (Rajasthan) |
| 56 | Saimah Khan | 2474 | Departmeant of Chemistry, Integral University, Lucknow –226 004 |
| 57 | Pati Sirisha | 2475 | Jagans College on Engineering and Technology, Nellore, Andhra Pradesh (INDIA) –524 320 |
| 58 | K. Rajalakshmi | 2476 | Shrimathi Indira Gandhi College, Trichy –620 002 |
| 59 | Dr. Sunil Vithalrao Gaikwad | 2477 | – |
| 60 | Dr. Kumara Swamy Gandla | 2478 | Chaitanya Deemed to be University, Hanumakonda, Telangana –506 009 |

L.M./IM No.:______________________ Receipt No.___________________

# ASSOCIATION OF CHEMISTRY TEACHERS (ACT)

Homi Bhabha Centre for Science Education
Tata Institute of Fundamental Research
103, NIUS Bldg.,V.N. Purav Marg,Mankhurd, Mumbai-400 088.
(Regd.No. Maharashtra Government, Mumbai 922,2010 G.B.B.S.D. dated 08/04/2010)
**Website:www.associationofchemistryteachers.org**

Date:______________________

To,
**The General Secretary,**
Association of Chemistry Teachers,
HBCSE(TIFR), Mumbai-400 088.

Dear Sir,

I/We wish to take the Life/Institutional Membership of A.C.T.
[Fees: Life Rs.1500/- and Institutional (one time payment) Rs.15,000/-]
A cheque/Demand Draft No.________________________ dated _________________ of Rs._________
drawn on _______________________________Bank, payable at par at Mumbai, in favour of “Association of Chemistry Teachers” is enclosed.(Outstation members should remit through demand draft only.)

1. Name :________________________________________________
2. Membership Sought : Life/Institutional
3. Qualifications :________________________________________________
4. Designation :________________________________________________
5. Date of Birth :________________________________________________
6. **Office address** :________________________________________________
   ____________________________________ PIN:___

Telephone : Fax: Email:

7. **Residential address** :________________________________________________
   ____________________________________ PIN:___
   Mobile: Landline: Email:
8. Area of teaching/research interest:_____________________________________________
   ________________________________________________________________

I am aware of the objective, rules and regulations of ACT and shall abide by them.

Place_____________________ Yours sincerely,
Date:______________________

(Signature)

All correspondence should be made to the General Secretary, Association of Chemistry Teachers, 103, NIUS Bldg., Homi Bhabha Centre for Science Education (TIFR), V.N. Purav Marg,Mumbai -400 088.

**FOR OFFICE USE ONLY**

ACT Membership awarded: Life/Institutional
Received from_____________________________________________ a sum of Rs.__________________
by Cash/cheque/DD no.___________________dated_________________ drawn on ___________________
Bank being the ____________________membership fees of ACT.
Membership No.:____________________
General Secretary Treasurer

ACT ACT

# ASSOCIATION OF CHEMISTRY TEACHERS

(Promoting Excellence in Chemistry Education)
Homi Bhabha Centre for Science Education (HBCSE, TIFR)
V.N. Purav Marg, Mankhurd, Mumbai - 400 088

www.associationofchemistryteachers.org


# ACT NEWS LETTER

ISSUE - 23 MAY - AUGUST 2022