TRC Newsletter

Making us effective in the innovation space

Volume 1, Issue 4, July 2018

Technical Research Centre

S. N. Bose National Centre for Basic Sciences

Editorial

With much joy and excitement, we are bringing in the fourth issue of the TRC Newsletter. This issue reports a few new items, the first being the initiation of setting up an incubation model and technology transfer via visits to Venture Centre, Pune, and ARCI, Hyderabad. This is an important step forward as TRC is mandated to generate marketable technology through basic science research. The time-span between April and July 2018 also saw us having the third National Advisory Committee (NAC) Meeting where the TRC progress was presented and evaluated. A nice discussion then ensued regarding the further progress of the TRC at the Centre, and the possible avenues for way forward.

This issue reports, for the first time and rather elaborately, on the prototypes built so far in the TRC project, and their utility. A nice market survey in this regard is also added to focus on the users' space. Activity reports by some of our TRC members, as has been the practice so far, decorate this issue as well.

A new instrumental facility "Vacuum RF Induction Furnace" has been installed, a few new members joined to increase the strength of the TRC, and a new office space in the building 'Vasundhara' allotted to TRC. The signature of growth is therefore indelible, and with the generous support and appropriate cooperation from the Centre, we are destined to make a lasting impact in the innovation space in the near future. With this positivity let us welcome the new arrivals – both in the form of new life on Earth, new members to the TRC Newsletter team, and most importantly, new patents under TRC leading to marketable technology!

Recent Events

- TRC PIs participated in FRACTAL programme of Venture Centre, NCL Innovation Park, Pune on 14th March, 2018.
- TRC PIs visited ARCI Hyderabad on 10th May, 2018 and interacted with ARCI team regarding technology transfer activities.
- The 3rd NAC meeting was held on 17th May, 2018.
- The Annual Evaluation Meeting for project staff and students was held on 22nd May, 2018.

Report of visit of TRC PIs' to participate in FRACTAL programme of Venture Centre, NCL Innovation Park, Pune, India

A 3-member team of TRC PI's visited the **Venture Centre, NCL Innovation Park, Pune** on March 14, 2018 to participate in the FRACTAL programme of the Venture Centre. The venture centre team consisted of Dr. Premnath, Director and Ms. Soma Chattopadhyay, Manger Incubation.

The visit focused on two issues

c) Feasible models of incubation in Govt. funded organizations like SNBNCBS and

d) Financial management of the incubator, revenue models and self sustenance

It was suggested that SNBNCBS under the TRC project can envisage formation of a Technology Translation Centre/Unit that would facilitate entrepreneurs who can work on technologies developed in TRC project or on ideas technology ideas developed by them.

Such a Translation Centre/Unit can choose prospective entrepreneurs through a screening process. A simple term for such engagement need to be worked out that will allow the prospective entrepreneurs to engage themselves with TRC activities. It was advised that the support to prospective entrepreneurs can be done through different NIDHI schemes.

Report of visit of TRC PIs' to ARCI, Hyderabad

TRC at SNBNCBS has started interaction with ARCI, Hyderabad in technology transfer activities. As a part of the interaction Dr. Sanjay Bhardwaj, Team Leader Technology Acquisition and Transfer group visited the center on October, 2017 for two days and interacted intensively with TRC PIs. A workshop was also arranged.

This was followed by visit of the TRC-SNBNCBS team to ARCI on May 10, 2018. The team had intense discussion with Dr. Sanjay Bhardwaj, Dr. T. Narasimha Rao, Associate Director and Dr. G. Padmanabhan, Director, ARCI. The team members have at least one prototype complete (non-biomedical). The scope of discussion was how to generate user testing and data and also contact prospective manufacturers for non-biomedical prototypes made at the TRC. The visit focused on two issues:

a) How to start field testing of identified prototypes.

b) Locating manufacturer / entrepreneurs who can take up the technologies, financial management of the incubator, revenue models and self sustenance.

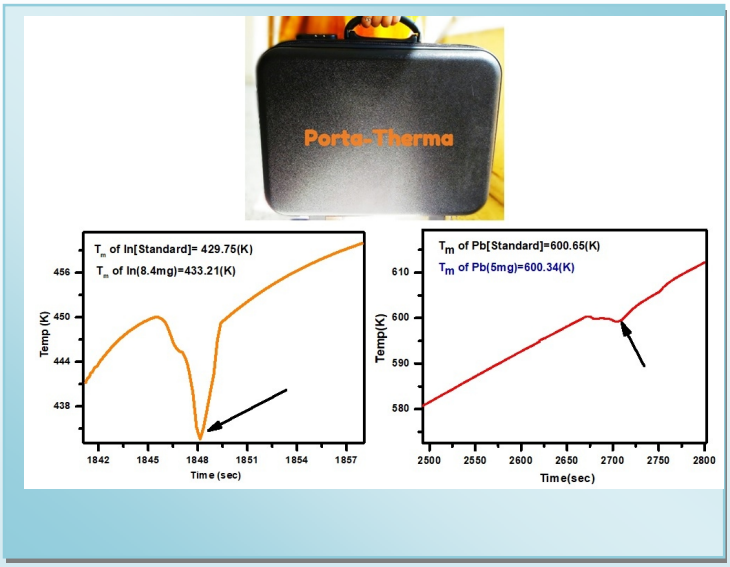
During discussion a broad strategy for user testing each product (given their diversity) was discussed and USP was identified. (Given the confidentiality in these strategies this is not to be disclosed in open document). It was decided that ARCI will provide help in both user testing as well as in manufacturer identification.

Patents of Interests

No	Title	Inventors	Application no.
1	Method And Apparatus For AC Differential Thermal Analysis	Michael Reading	US005439291A
Abstract: The present invention is a modulated differential thermal analysis technique for determining the composition, phase, structure, identification, or other properties of a material that undergoes a transition as function of temperature or other driving variable. As applied to differential scanning calorimetric analysis (DSC), the preferred embodiment comprises (1) heating a sample of the material with a linear temperature ramp that is modulated with a sinusoidal heating rate oscillation; (2) simultaneously heating a reference at the same linear temperature ramp; (3) measuring the differential temperature of the sample and reference; and (4) de-convoluting the resultant heat flow signal into rapidly and non-rapidly reversible components.			
2	Ammonia Concentration Detection Sensor	Takashi Ito, Sang Jae Lee	US8584504B2
Abstract: An ammonia concentration detection sensor has a sensor element capable of detecting the ammonia concentration of a measurement target gas; and a protective cover that regulates the inflow of the measurement target gas into the sensor element and protects the sensor element. The protective cover is coated with a coating layer.			
3	Nanogenerator Comprising Piezoelectric Semiconducting Nanostructures And Schottky Conductive Contacts	Zhong L. Wang, Marietta Xudong Wang, Jinhui Song, Jun Zhou, Jr-Hau He	US008039834B2
Abstract: A semiconducting device includes a substrate, a piezoelectric wire, a structure, a first electrode and a second electrode. The piezoelectric wire has a first end and an opposite second end and is disposed on the substrate. The structure causes the piezoelectric wire to bend in a predetermined manner between the first end and the second end so that the piezo electric wire enters a first semiconducting state. The first electrode is coupled to the first end and the second electrode is coupled to the second end so that when the piezoelectric wire is in the first semiconducting state, an electrical characteristic will be exhibited between the first electrode and the second electrode.			
4	Processes For Decolorization Of Colored Effluents	Chandralata Raghu Kumar Donna Trella D'Souza Ticlo	US8017374B2
Abstract: The present invention relates to a novel process for decolorization of colored effluents. More particularly it relates to a process for decolorization of colored effluents of textile mills, dyemaking industries, paper and pulp industries and molasses spent wash from alcohol distilleries using an unidentified white-rot marine fungus NIOCC isolated from mangrove wood and deposited on Sep. 7, 2004 in the microbial type culture collection (MTCC) of the Institute of Microbial Technology, Chandigarh, India, under the accession number MTCC 5159. Further, this invention relates to decolorization of these effluents using the fungus directly, its cell-free culture supernatant or immobilized fungus or extracellular polymeric substances produced by the fungus. Furthermore, the decolorization of effluents can be carried out from 30° C. to 60° C and at pH 3 to 6. The decolorization of various colored effluents occurs in the presence of sea water with 25 parts per thousand salinity. Several synthetic dyes are also decolorized under similar conditions of temperature and pH by using free mycelia or immobilized fungus or extracellular culture fluids or extracellular polymeric substances.			
5	Piezoelectric Nanowire Structure And Electronic Device Including The Same	Duk-Hyun Choi, Jae-Young Choi,	US008785914B2
Abstract: A piezoelectric nanowire structure includes a base substrate, a plurality of piezoelectric nanowires disposed on the base substrate, and a piezoelectric organic material layer disposed on the base Substrate and covering the plurality of piezoelectric nanowires.			
6	Breath Test For The Diagnosis Of Helicobacter pylori Infection In The Gastrointestinal Tract	Daniel E. Katzman	US6067989A
Abstract: A breath test for diagnosing the presence of Helicobacter pylori in a subject is described. The method of diagnosing Helicobacter pylori is performed as follows. First, a safe and effective amount of urea, preferably appropriately labelled, is administered to the subject. Second, a plurality of the exhaled breaths of the subject is analyzed to detect the concentration of a cleavage product or products, produced when urease cleaves the substrate. The measured concentrations are then fitted to a curve, and the derivative is then calculated, to indicate the presence or absence of Helicobacter pylori infection in the subject.			

Prototype Developed

Porta-Therma: A portable low cost thermal analyzer



A **thermal analyzer** is a valuable physic-chemical analytical tool. A thermal analyzer can measure such basic quantities such as melting point, specific heat, enthalpy change at melting or at a temperature where a phase change occurs. Often physical and chemical processes involve a change in energy usually accompanied by heat release or absorption often at a temperature where a phase change occurs. Thermal analyzers working over a broad temperature range can measure the heat release/absorption as the material under test is heated through the temperature range of phase change, like its melting point. If made portable this can be used even as a field usable tool by a number of industrial and test laboratories. If the cost is made lower it can be afforded by a large number of users particularly in MSME sectors.

The commercial analyzers available as Differential Scanning Calorimeter (DSC) are mostly table top equipment requiring power points (also bulky) and the cost factor may also be high. ***The TRC project has developed a portable thermal analyzer that can be carried like a brief case and has its own built-in power supply so that availability of a line power is not an essential requirement.*** The portable equipment carries the name "Porta-Therma"(a short form of portable thermal analyzer) can work in the temperature range of 35^0C to 400^0 C and can measure melting point of solids (with an accuracy of ± 0.7%) and heat capacity with an accuracy of nearly ± 5%. The system has been calibrated (for its temperature scale) using melting points of reference materials that form part of ITS-90. The "Porta-Therma" uses low cost computer systems and electronics with a pad as the display and a touch-screen operation using a pad. The system can send data by cloud. The minimal system and the first prototype is being tested for prolonged operation and accuracy of data in the stated range of operation (35^0C to 400^0 C). The graphic user interface (GUI) is being made user friendly with the hardware part being upgraded for a better usability and ease of user operation.

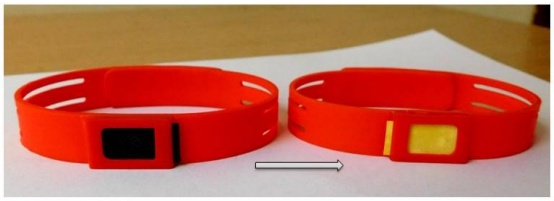
Pyro-Breath

A prototype breath analyzer, so called "**Pyro-Breath"**, has been developed in the TRC project. The analyzer can diagnose stomach infection and ulcer disease by means of human breath analysis. Exhaled breath contains a large number of different molecular species with ultra-low concentrations in the levels of parts per billion (ppb) to parts per trillion (ppt). Some of these molecules and their isotopes are closely associated with the development of disease or metabolic disorder in human.

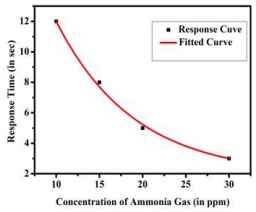
However, the present system measures such molecular species in real-time which are usually called biomarkers or "breath-print". The present technique is a non-invasive method without the need for painful endoscopy-based biopsy tests. As this is a non-invasive method, the diagnosis should be attractive for infants, children, and pregnant women as well as for seniors. Moreover, the analyzer can be used as a point-of-care (POC) instrument in hospitals or clinics for routine clinical check-up through breath test. The system can also be used even after the eradication of the infection or standard therapies. It is also useful for early detection of the infection as well as for follow-up of the patients. The device is now under clinical investigation for large-scale clinical validation.

Prototype Developed

Ammonia Sensor



Ammo-watch changes colour from black to yellow in ammonia gas



A prototype has been developed on "**paper based fast response ammonia sensor with visual effect**" **for assessments and early warning for a hazardous environment.** The innovation involves a cheap rapid paper sensor (working at room temperature) to detect presence of the toxic ammonia gas by just colour change, where the black coloured sensor film (on the paper) changes to yellow colour in presence of a very low concentration of ammonia gas. Ammonia is a toxic and hazards pollutant in environment. Detection of the presence of NH_3 at a low level is most desirable. Most of the thin film-based gas sensors available are electrical signal based and would need a peripheral arrangement for detection of the gas. It is envisaged that if a colour change sensor can be made where a visual detection can detect the hazardous gas in ppm level that would make it extremely easy to use as well as cost effective and maintenance free.

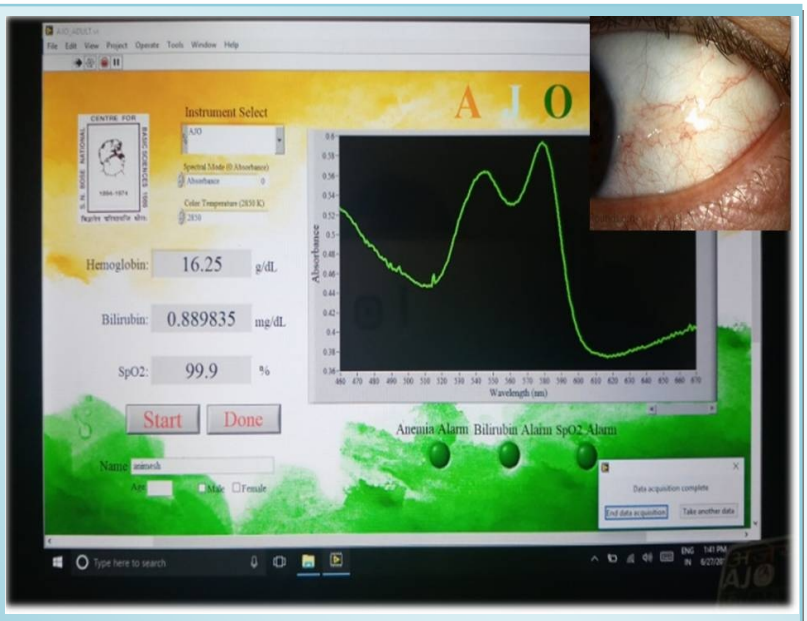
As examples, colour change sensors based on papers are widely used for pH measurements as well as for measurements of glucose level in urine. However, such easy to use sensors are not available for hazardous gases till date. Such a colour changes visual sensor based on simple paper, where exposure to ammonia can be detected quickly at room temperature with high selectivity as well as sensitivity (e.g. down to ~10 ppm).

MILK-Q: A hand-held device for cheking adulteration in milk at all weather condition and in open environment

MILK-Q: A handheld device for detection of adulteration of milk which can easily detect organic and inorganic adulterants present in milk via property measurements. This is simple enough to be operated by non technical persons and at all weather condition. This will be field usable and not required testing in a specialized remote lab. This will prevent mass consumption of adulterated milk. Prototype is shown in the figure. Further developmental work leading to miniaturisation of this device is being carried out now.

Prototype Developed

AJO Device (अजेययंत्र / অজেয়যন্ত্র)



Anemia, Jaundice and Oxygen deficiency monitoring device aka **AJO Device** is a composite device which can detect the haemoglobin count in blood, the bilirubin level in blood vessels and the oxygen saturation of the same. This is a non-invasive and non-contact technique in which a white light at intensity 2041 lux is used to illuminate the conjunctiva of the eye. The retro reflected light from the surface of the conjunctiva brings the information of whole blood in terms of optical density and the spectrograph plots the spectrum. From the graph the optical density of particular wavelengths are selected for data analysis.

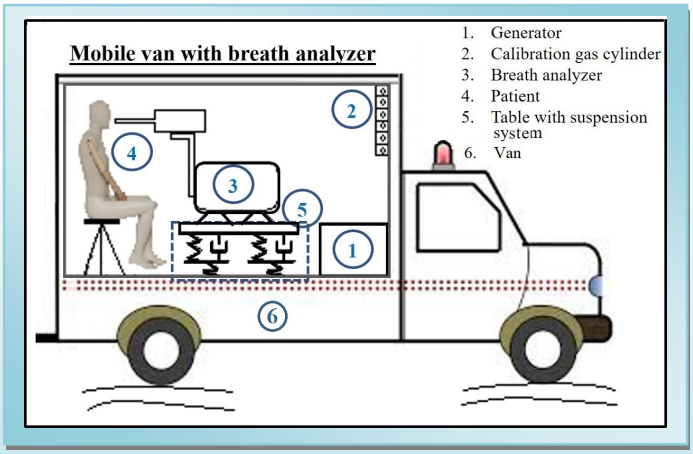
The prototype consists of one LED source, one visible range spectrograph, an electronic unit to provide sufficient drive so to glow the LED at said intensity.

A probe with six illumination fibers and one collection fiber is required to excite the conjunctiva with the light and to carry back the reflected light to the spectrometers. A tablet is required to visually control the entire operation of the instrument. Indigenous multitasking software coded in LabVIEW platform loaded with the startup of the tablet. The software provides an easy user interface between the user and the instrument. The data acquisition, analysis of the captured spectrum, decision making and electronic report generation are also included in the software working protocol. The instrumental set up and the instrumental panel with detected whole blood spectrum is shown in the above image. The graph shows the optical absorbance of the blood at visible range. The optical probe needs to be held normal to surface of the conjunctiva. A specific light spot appears on the region of interest. The spot is vital in decision making. The spectrum will considered as valid one once the spot diameter matches the set diameter value. The final spectrum analyzed by the software and the values of the three parameters will be displayed on the screen. Individual threshold values for each parameter are loaded in the software with the medical reference; and if the analyzed value of a spectrum under investigation goes above the threshold, an alarm generates.

Current Activities - Staff & Students

Mobile Van for Gas/Breath Analyzer

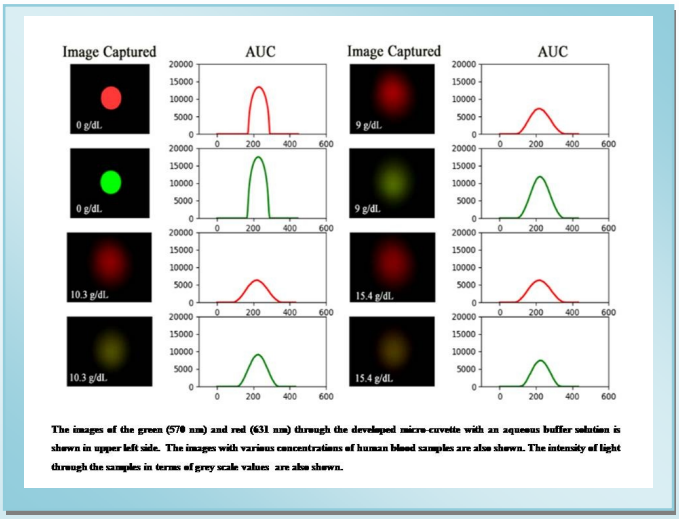
Anil C Mahato



A newly developed **Breath Analyzer** will be installed into a mobile van. The main objective of this work is to collect exhaled breath samples from patients in different places (e.g. rural/urban areas) for large-scale clinical validation. The analyzer will specifically diagnose stomach infection and ulcer disease by means of breath analysis which is a non-invasive process. A vibration isolation system has been developed inside the mobile van where the Breath Analyzer system will be installed and this will protect the analyzer from vehicle jerk. A schematic diagram of the proposed system is depicted in the above figure.

Development of Digital Camera based System for Anaemia Detection using Ultra-Low Volume Whole Blood Sample

Animesh Halder



Development of a faster and reliable instrument for early detection of low haemoglobin from whole blood at point-of-care is challenging in source limited point of care setting. We have developed a digital camera-based spectrometer for the early detection of anaemia with whole blood of 10-μL volume (A. Halder et al., "Digital Camera-Based Spectrometry for the Development of Point-of-Care Anaemia Detection on Ultra-Low Volume Whole Blood Sample," in IEEE Sensors Journal, vol. 17, no. 21, pp. 7149-7156, Nov.1, 2017). The developed device consists of a source of two wavelengths 570 nm and 631 nm, a web camera, a fluid sensing chamber (cuvette holder), and associate electronics. The haemoglobin concentration information could be extracted from the whole blood using Beer–Lambert law of various degree of dilution. The developed instrument is under clinical trial at NRS medical college for validation in larger human population. The device is expected to serve as a minimally invasive e-health care device for the anaemia screening in any resource-limited point of care setting.

Current Activities - Staff & Students

Market Based Technology Analysis to Identify Strength and Weaknesses of TRC products

Suchismita Banerjee

Search of available technologies, patents and journal publications form an important part of activities in TRC in order to place the TRC activities and technologies developed in a competitive platform. It also helps us to identify the strengths and weaknesses of the products and technologies being developed. Our activities in this area are done through web search and thus form a support to the different activities under TRC. In last few months our activities were focused on three areas. Namely: Ammonia paper as visual sensor, hand held milk tester and portable thermal analyzer.

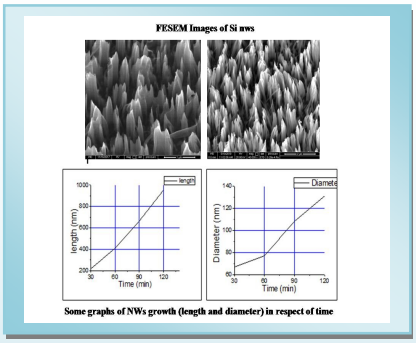
Ammonia gas is corrosive in nature and causes blindness, lung damage even death. TRC has developed an ammonia paper called **"Ammo-Watch"**. This colour change sensor that has a minimum delectability around 10 ppm in open ambience. This is a zero energy based, efficient, highly selective, cheap visual ammonia gas sensor with 6 months self life. A thorough internet research had done to search if similar products available in market and also to understand advantages/disadvantages of our product over already available ammonia sensors in market.

TRC wants to give a low cost, user friendly; milk property measurement based hand held analysis kit to all Indian kitchens to stop life threatening diseases from adulterated milk. A preliminary market analysis and paper review has been done to know about availability of this kind of product or research papers.

"Porta-Therma" is a low cost, portable; thermal analyser with many unique features. Internet research has been done to review many papers, patents, and products to identify similarities with our product if any.

Si Nanowires Growth by Chemical Etching

Abhishek Bhattacharya



Some graphs of NWs growth (length and diameter) in respect of time

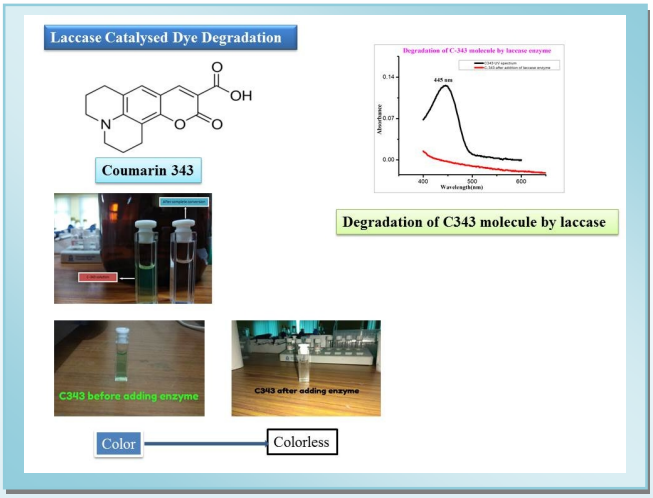
Nanowires (NWs) are one-dimensional nano materials with length in range of micrometer and diameter in range of nanometers or tens of nanometers. Silicon NWs are used in the field of optoelectronics, sensors, and phovolatic. In TRC project arrays of Si NWs are used for high senistivity gas sensing by «fucntionalizing» the nanowires with suitable active maetrials. Chemical etching is a practical method, used to grow varticaly alligned Si nws array on Si surfaces. We have chosen chemical etching to grow Si NWs as no complex equipment, no high tempereture, and no vacume are requierd. The fabrication method is consists of three major steps including RCA cleaning, etching and finally acid rinsing.

Till date we have completed batches reaching about 80. Every batch involves change of one parameter/ condition and keep others parameters/ conditions fixed. Batches are repeated which give uniform distribution of Si NWs. Process is optimized from non uniform distribution to uniform distribution and non uniform to uniform length of Si NWs. Very good repeatable Si NWs growth is obtained in terms of uniform distribution, uniform length, and uniform diameter.

Current Activities - Staff & Students

Laccase catalysed biodegradation of Xenobiotic Compounds: Treatment of Industrial Effluents

Indrajit Manna



Laccase is an enzyme that contains four copper atoms per unit and is available in the nature as dimeric or tetrameric glycoprotein. Common source for this enzyme is mainly plant and fungi, and possesses the uncanny ability to degrade synthetic harmful chemicals to less virulent ones.

Our project in TRC envisages study of enzyme catalysed degradation of hazardous organic compounds and taking this study towards technological application. The enzyme chosen is naturally occurring Laccase which we also plan to extract from the natural sources, purify and use. Just as a beginning, we have started exploring Laccase-induced degradation of small organic molecules. Inhibition of enzymatic activity by organic molecules is a critical concern here. Results from this initial study were shown here.

We have done our experiment with an organic dye molecule i.e, Coumarin 343 and we saw that this compound was degraded by Laccase enzyme. We have taken UV-Vis spectrum and fluorescence spectrum of this dye compound and also, we have seen the changes of absorption peak and intensity peak of the molecule after addition of Laccase enzyme. Then we measured the degradation kinetics of this molecule with Laccase enzyme by varying concentration.

New Office Space Allotment

A new office space has been allotted to TRC in “Vasundhara” building

Facilities/ Instrument Installation

Installation of New Facility in TRC:

Vacuum RF Induction Furnace/Melt Spinning Unit for Alloy Preparation (May 21, 2018).

Supplier: VACUUM TECHNIQUES PVT. LTD, Bangalore

Melt Capacity: 2 to 12 gm.

Advanced Facility for Rapid Solidification of Metallic Alloys

Happy Notes

Event: Rice eating ceremony of ***Aaditri (Theia)***, daughter of Mrs. Suchismita Banerjee and Mr. Abhishek Bhattacharya
Date: 27th April, 2018
Venue: Radhachura Dining Hall

Team-TRC congratulates Dr. Anil C Mahato for being blessed with a baby boy ***Aarush*** on 06/03/2018

Team - TRC

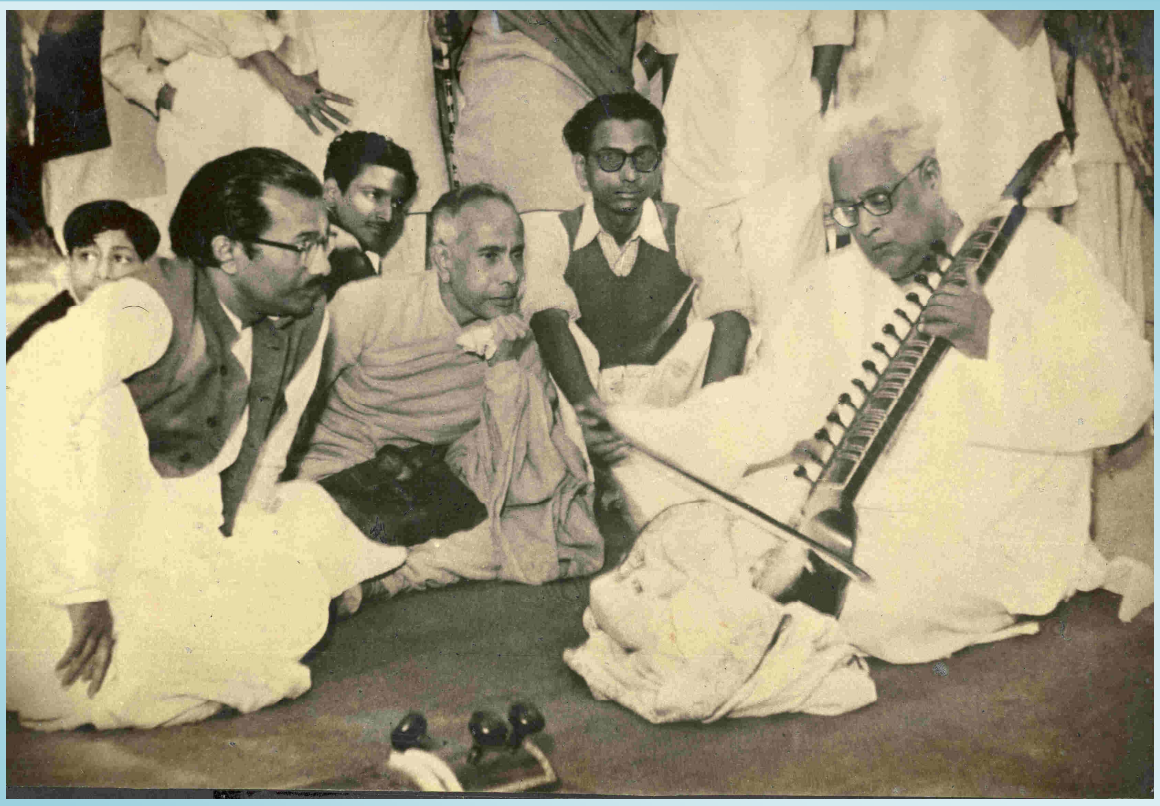
Left to Right (Below Photograph):

Prof. Manik Pradhan, Prof. Ranjit Biswas, Indrajit, Prof. Arup K. Raychaudhuri, Sirshendu, Abhijit, Suman, Prasenjit, Suchismita, Saheli, Abhishek, Sayoni, Anil, Manik, Snehamoyee, Arnab, Uttam, Ayan, Lopamudra, Sujoy, Soumita, Arindam, Kanika, Animesh, Susmita, Gurdeep, Prof. Pratip K. Mukhopadhyay.

Our New Members

Susmita Dey, Animesh Halder, Soumita Bera, Ankita Ghatak, Uttam Pal, Kanika Kole, Abhijit Maity

Instrumental Moment



Satyendra Nath Bose playing the Esraj for the Mahalanobises on the occasion of a wedding anniversary

Editorial Board

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