TRC Newsletter

Making us effective in the innovation space

Volume 1, Issue 3, April 2018

Technical Research Centre

S. N. Bose National Centre for Basic Sciences

Editorial

It is a pleasure to publish the third issue of the TRC newsletter. This quarterly issue reports a few new events, most notable being the arrangement of "TRC day: Where Do We Stand Today?" where most of the TRC personnel enthusiastically presented their work, and critically evaluated the progress, both at the individual and collective levels. It is indeed a joy to mention that our TRC has made substantial progress in patent generation and translating a few of them to the prototype stage. Of course, this progress has not come without facing any difficulties, but then no good work can be accomplished without surmounting a sizeable barrier. The difficulties and barriers have made us more determined and focused. The generous help from the authority then indeed encouraged and inspired us to conquer the unseen frontiers.

Apart from a brief summary on TRC Day, this volume reports on (i) a literature survey on patents that are somewhat relevant to our activities in the TRC, (ii) participation of a small TRC team to an Industry-Academia meet in a nearby host institute, (iii) brief summary of the works carried out by six TRC resource persons. The last is in a continuation of the previous issue where we covered six other topics and this trend will continue in the next issues.

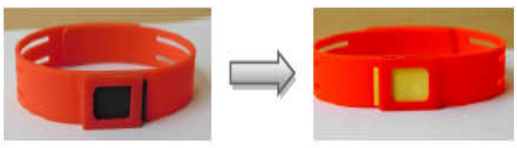
We do hope to report more exciting events on TRC progress in the future issues. We wish a great Bengali New Year! Subho Nababarsho!

TRC Day: Where do we stand today?

On 26th February, 2018 we organized nearly a full day symposium where most of the TRC resource persons presented their progress on the project work they were involved. The purpose of this presentation was self evaluation of our current status on our respective work envisaged in the TRC project. The day started with the foreword by Prof. A. K. Raychaudhuri, TRC Nodal Officer followed by an inauguration speech by Prof. S. K. Ray, Director, S. N. Bose National Centre for Basic Sciences. We are thankful that in spite of busy schedule, Prof. S. K. Ray was able to spend an hour with us and listened to few of the presentations.

The individual presentations were on the following topics (each of the presentation was not more than 20 minutes) and they dwelt on the following titles.

Sl. No.	Seminar Topic	Presenter
1	Analysis of Adulterated Milk Using NIR Spectroscopic Method	Lopamudra Roy
2	Fabrication method of Si nanowire for gas detection	Abhishek Bhattacharya
3	Development of Hand-Held Device for Detection of Adulteration in Milk	Arnab Sil
4	Development of Light Operated Micro-Actuator: Design of Specific Alloy System	Suman Sarkar
5	Evaluation of Basic Mechanical Properties of the PIMA effect	Gurdeep Singh
6	Design of a Medical Device Box	Anil C. Mahato
7	Flexible Paper Based Sensor for Ammonia Gas Detection	Ayan Kr. Ghosh / Prasenjit Chakraborty
8	Laccase Induced Degradation of Hazardous Organic Molecules	Indrajit Manna
9	Metal Organic Frameworks and its Applications Towards Gas Sorption and Sensing of Hazardous Chemicals	Sonali Ghosh
10	Nanoporous Materials for CO2 Adsorption	Arindam Modak
11	Piezoelectric Energy Generation and Harvesting by Using PZT Nanowire	SnehamoyeeHazra
12	Porto-Therma	Saheli Samanta
13	Sensing of Melamine Using Surface Plasmon Resonance Technique & Calibration of Residual Gas Analyser	Sayoni Bhattacharya



Ammo-Watch changes color from **black** to **yellow** in presence of ammonia gas

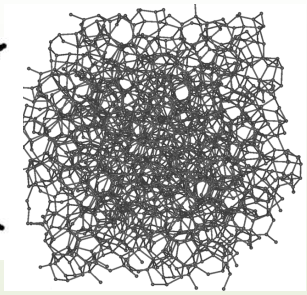
Patents of Interests

NO.	TITLE	INVENTORS	APPLICATION NO.
1	**Ammonia gas detection apparatus and a semiconductor fabrication line including the same**	**Sungman KIM, Jin Ha Jeong, Jongsan Kim, Ronald Myungsup Shim**	**US 9291571 B2**
Abstract: An ammonia gas detection apparatus includes an ammonia sensor that is configured to detect an ammonia gas in a gas stream and to generate a first output signal when the ammonia gas is detected in the gas stream. The ammonia sensor does not detect the ammonia gas in the gas stream when the gas stream further includes an interference gas that disrupts operation of the ammonia sensor. A discoloration gauge includes a reaction solution that changes from a first color to a second color responsive to exposure to the ammonia gas in the gas stream, regardless of the presence of the interference gas, and a detector that generates a second output signal responsive to the reaction solution changing from the first color to the second color. A communication interface outputs the first and second output signal to a host computer that detects presence of the ammonia gas.			
2	**Device useful for sensing ammonia and nitrogen oxides(s) gases at room temperature**	**Ram Pratap Gupta, Purushottam Das Vyas, Zenko Gergintschew, Dagmar Schipanski**	**US 5866075 A**
Abstract: A device for sensing ammonia (NH_3) and nitrogen oxide (NO_x) gases comprising: a sensor for detecting said ammonia and said nitrogen oxide gases, said sensor including a substrate and a layer consisting of cuprate material for detection of said ammonia and said nitrogen oxide gases, wherein said layer of cuprate material is selected from the group consisting of Y:Ba:Cu:O (YBCO) and Bi:Sr:Ca:Cu:O (BSCCO); a sensor holder for supporting said sensor; a perforated cap positioned over said sensor, said perforated cap having openings for passage of said ammonia and said nitrogen oxide gases to said sensor; a detection circuit communicating with said sensor for measuring output from said sensor; and a display or recording device connected to said detection circuit for displaying or recording a concentration of said ammonia and said nitrogen oxide gases based on the output from said sensor.			
3	**Nitric oxide detector element**	**Kouichi Hiranaka, Yoshihiko Sadaoka, Yoshiteru Itagaki**	**EP 2602616 A1**
Abstract: Provided is a nitric oxide detection element which is capable of measuring a trace amount of NO gas contained in a gas in a scale of several ppb and of which the time degradation in performance is suppressed. The nitric oxide detection element includes at a surface thereof: a dye having a porphyrin skeleton and containing divalent cobalt as a central metal; and a radical scavenger. The nitric oxide detection element includes a substrate 12 and a sensing film 11 formed on a surface of the substrate 12. The sensing film 11 may contain the dye and the radical scavenger.			
4	**Air cleaner filter system capable of nano-confined catalytic oxidation**	**Kwok Yung Anthony Law, Yu Hang Christopher Chao, Sui Chun Law, Wan chung Lam**	**US 8883083 B2**
Abstract: The present invention is an air cleaner that uses molecular sieves, such as zeolite or other microporous/nanoporous crystalline materials with pore sizes ranging from 4 □ to 20 □, as a filter to remove contaminant gas. The contaminants are adsorbed into the porous material along with ions clusters, or any other oxidant generated by a generating device within the system. The contaminant gas is then catalytically decomposed in the confined space of the pore. In one embodiment, transition metal is incorporated into the porous material, and a heater is installed to substitute or accompany the oxidant-generating device. When the heater is turned on, the contaminant is decomposed within the pores of the materials with the transition metals acting as catalysts. Ultimately, the non-harmful byproducts are the small sized water molecutes and carbon dioxide molecules. Growth of bacteria is also suppressed under a clean and dry condition			
5	**Kit for detecting stomach diseases**	**Lumei Zhen**	**CN 105929161 A**
Abstract: The invention relates to a kit for detecting stomach diseases, belonging to the technical field of in-vitro reagent diagnosis. A nucleic acid aptamer which can be specifically combined with pepsinogen II can be obtained by screening by an SELEX technology, so that the pepsinogen II in blood is specifically screened or detected by utilizing the aptamer; and the aptamer is prepared into the detection kit, and the aim that the blood does not need to be diluted and is directly reacted to detect so that the working amount is alleviated is realized; and meanwhile, a wide measurement range is obtained and the kit is convenient for clinical utilization. The kit has the positive significances of high sensitivity, good specificity, wide measurement range and simplicity in operation, facilitation of large-scale popularization and application and wide market prospect.			
6	**Apparatus and method for noninvasive blood glucose monitoring**	**Theodore H. Stanley, Charles D. Ebert, William I. Higuchi, Jie Zhang**	**US 5139023 A**
Abstract: The present invention is directed to novel methods and apparatus for noninvasive blood glucose monitoring. Blood glucose is monitored noninvasively by correlation with amount of glucose which permeates an epithelial membrane, such as skin or a mucosal membrane, into a glucose receiving medium over a specified time period. The glucose receiving medium preferably includes a glucose permeation enhancer capable of increasing the glucose permeability across the epithelial membrane. The glucose receiving medium is positioned against the epithelial membrane so that the permeation enhancer alters the permeability of the membrane. After sufficient time delay, the glucose receiving medium is removed and analyzed for the presence of glucose using conventional analytical techniques. The apparatus within the scope of the present invention includes means for supporting the glucose receiving medium. Such means for supporting the glucose receiving medium may include a housing defining a receiving chamber therein which holds the glucose receiving medium and an opening to the receiving chamber. The means for supporting the glucose receiving medium may also include a hydrogel. The apparatus also preferably includes means for temporarily positioning the glucose receiving medium against the epithelial membrane.			

Current Activities and Deliverables

Title : Synthesis of nanoporous organic materials for CO_2 adsorption

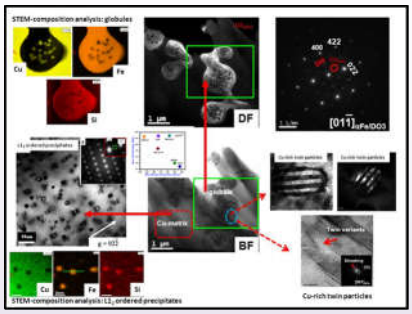
Dr. Arindam Modak



Abstract: Organic nanomaterials are recently being explored as next-generation scaffold for solving burning issues like energy crisis and environment-related problems. By introducing porosity in these nanomaterials, we could tailor their potential applications in gas adsorption and separation purposes. According to IUPAC (International Union of Pure and Applied Chemistry) rules, porous nanomaterials have been classified into microporous (pore size < 2 nm), mesoporous (pore size between 2-50 nm) and macroporous materials (pore size > 50 nm), irrespective of their chemical composition. Among these, microporous materials are promising for gas storage and separation purposes because of the great advantage of small pores. Our objective is to construct materials for CO_2 adsorption purposes with high uptake capacity as well as would meet the cost-effectiveness of the synthesis process. In order to circumvent the issues, we synthesized amorphous nanocarbon from waste residues after several pyrolysis and activation processes. For post-combustion CO_2 capture purposes having high CO_2/N_2, CO_2/H_2O separation selectivity, we are working on the structural engineering of the nanocarbon.

Title: Development of novel materials through microstructural engineering

Dr. Suman Sarkar



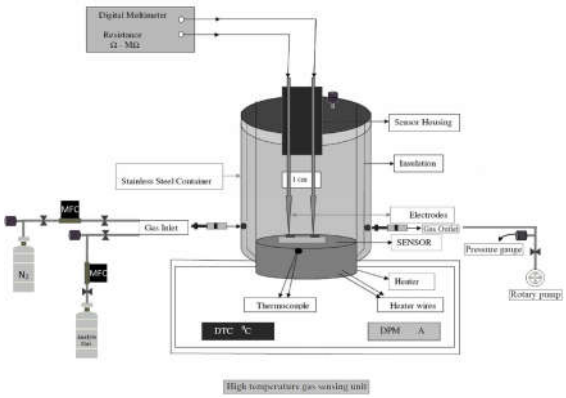
Copper based alloys play important role in high heat flux applications, particularly in rocket technology, in particular the liner of the combustion chamber, and also in other heat transfer vessels. These applications demands excellent high-temperature strength without sacrificing the thermal conductivity significantly. However, it is a challenging and difficult task to significantly improve the balance between strength and conductivities (electrical and thermal) of Cu-based alloys. In general, microstructural attributes, responsible for increasing mechanical strength of the alloy, also affect the transport properties by creating scattering centers. Hence, delicate optimization is needed for developing balanced alloy system for better performance. This problem can be tackled through tuning of phase transformation and careful additions of ternary and quaternary alloying elements and ultimately by microstructural engineering.

In this present work, we have explored the possibility of obtaining structurally ordered intermetallic dispersions through exploiting immiscibility of solutes in copper based alloys. The immiscibility promotes precipitation and decrease the solid solubility of solute elements in the matrix which in turn minimizes the scattering process and thus offers the possibility of improved transport properties. In the current work, we have developed a new class of copper based alloys (IIScCu-75 series) where strengthening dispersoids have ordered structure. The Cu-Fe system shows submerged miscibility gap in the metastable phase diagram.

Student Activities

Title: Gas mixing panel for gas sensor calibration

Mr. Prasenjit Chakraborty



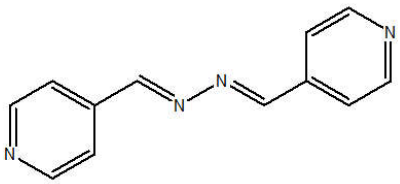
High temperature gas sensing unit

Protection of specialty personnel and civilians from harmful contaminants or pollution in the air supply has been and remains a major challenge. Overcoming this challenge would require the development of very sensitive, reliable, and cheap devices that could be used to detect small amount of these pollutants in real time. A good sensor is the one that can be used to detect, record, and transmit information about the presence of various pollutant or toxic gases such as hydrogen sulfide (H2S), ammonia (NH3), methane (CH4), and sulfur dioxide (SO2) in the environment. The sensor should be low cost and highly sensitive which can go down to ppb levels.

All sensors normally need to be tested and calibrated before applications. For this reason a suitable test chamber need to measure sensor's sensitivity, selectivity etc. It should be constructed of inert materials such as glass, polytetrafluoroethylene (PTFE) or stainless steel, depending on the substance to be measured, so that it cannot contaminate the chamber. The chamber will be equipped with systems that will be able to measure, control and change the rate of airflow through the chamber and the concentration, temperature and relative humidity of the test gas. It is necessary to control ambient pressure in the exposure chamber. Since a large number of tests have to be performed, it is suggested to automate the control of the exposure chamber with a programmable system under different controlled conditions of temperature, humidity, concentration of gas pollutant and interference. Our proposed design of exposure chamber is given in Figure. My ultimate goal is to design and develop a simple, low-cost gas exposure chamber, where up to ppm level of any target gas can be measured by gas sensing device.

Title: Metal organic frameworks and its applications towards gas sorption and sensing of hazardous chemicals

Ms. Sonali Ghosh



N,N'-Bis-pyridin-4-ylmethylene-hydrazine

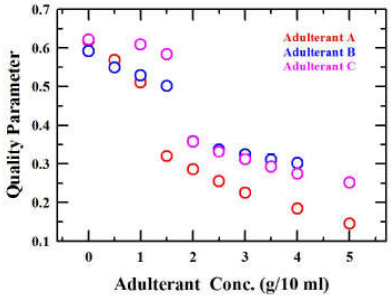
Metal-organic frameworks (MOFs) have recently emerged as an important class of porous hybrid organic-inorganic materials for their amenability to design and the flexibility with which their pores that can be functionalized . In particular, their extraordinary low density (1.00 to 0.20 g/cm^3) and high surface area (500 to 4500 m^2/g) make them ideal candidates for the storage and separation of gases (N_2, CO_2, CH_4, and H_2). In this context, identifying the gas adsorption sites in MOFs is critically important to our ability to fine-tune those sites, sterically and electronically.

In order to achieve the maximum storage capacity and selectivity, we have synthesized some suitable conjugated long organic ligands in our lab which is suitable to form MOFs for better gas sorption as well as sensing of hazardous chemicals based on luminescence properties.

So far, the inability of these open frameworks to support permanent porosity and to avoid collapsing in the absence of guest molecules, such as solvents, has hindered further progress in the field. The rigid and divergent character of the added linker allows the articulation of the clusters into a three-dimensional framework resulting in a structure with higher apparent surface area and pore volume than porous crystalline zeolites. Simple and potential ligand design and synthesis is my current working status along the synthesis of MOFs.

Title: Hand-held device for detection of adulteration in milk

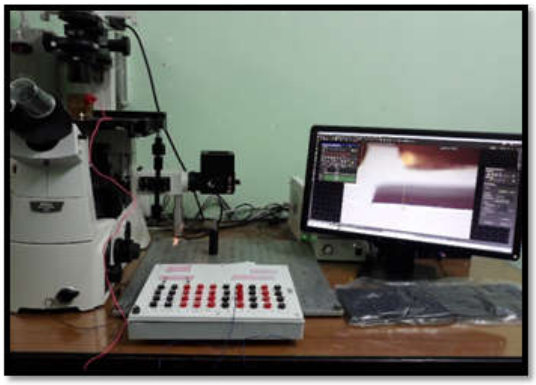
Mr. Arnab Sil

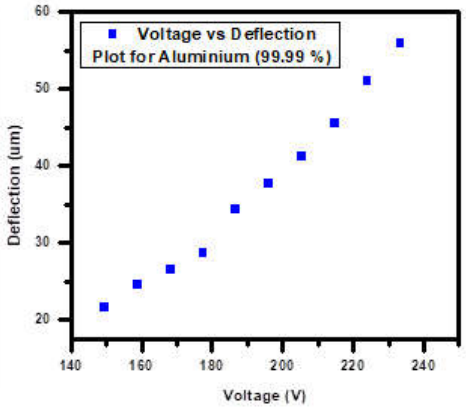


We are trying to make a device which is related to easy detection of organic and inorganic adulterants present in milk via electrical measurements. The proposed device would be hand held, user friendly, cheap and appropriately sized for transportation and operation in open environment, particularly in the milk production and collection areas and booths. This should be robust enough to be operative by minimal knowledge, and free of weather condition in Indian scenario.

Title: Development of light operated micro-actuator using photomechanical actuation of ferromagnetic shape memory alloy and related materials

Mr. Gurdeep Singh





Worldwide the problem of blockage of blood flow through the arteries, especially coronary or carotid ones, is leading to serious consequences. This happens due to building up of the plaques or cholesterol deposits in the arteries, leading to heart attacks or strokes. While the standard ways are Coronary Artery Bypass Graft and Percutaneous Coronary Intervention, the end result is either too time consuming or has a problem of needing reintervention after some time. We are trying an alternative route through Atherectomy in arteries with distal embolization protection device, using the photomechanical actuation effect to build a small scrapper in front of the catheter. The light tube here would double up both as a guide and a conduit for carrying the controlling light pulses.

Participation of TRC Team to the Industry-Academia meet at IISER Kolkata

A small TRC team (Ranjit Biswas, Ankita Ghatak, Suman Sarkar, Sirshendu Dinda, Anil Chandra Mahato and Ayan Kumar Ghosh) participated in the Industry-Academia Meet at IISER Kolkata on February 7, 2018 and meet various members over there.

Prof. Biswas interacting with panel members

The topics that were covered include:

- **Academia-Industry Partnership**
- Panel discussion on **Building Ecosystem for Translating Ideas from Bench to Market**.
- **Public-Private Partnership and Technology for Sustainability**: Case Studies.

This 'one day visit' in IISER-Kolkata has reflected a bunch of experiences on translational research. The key players from industry and academia have shared their ideas and tried to find out different roadmaps which will lead to an ecosystem that would sustain translational research. The expertise available at the host institute has presented their current activities and strength of research areas in front of the industry for future potential collaboration.

The expectation of industry from the academia and the vice versa has been discussed point by point by various participants. The relevance and the reality of the newly initiated research work in laboratory scale should be much focused and this particular phrase (relevance and reality) was the main theme.

The critical role of a scientist in the decision making of a company was stressed upon and to succeed by standing up against failures, it has to borrow the creativity of a group of scientists.

Useful information came out from the investor sides regarding the investment policy during the panel discussion. A very vibrant and interdisciplinary team along with a potential market-oriented research idea can attract and excite the investors for scaled up research programme.

TRC's take on this meet:

- Organize meet/conclave with market players to showcase our research activities.
- Explore ways for more regular interaction and discussion session with the relevant market players for a collaborative approach on Lab-to-Market science findings wherever possible.

Seminars/Colloquium

NO.	DATE	NAME	TOPIC
1.	02/02/2018	Dr. A. Pramanik	Lab-to-Market Transition of Research
2.	01/02/2018	Dr. Arindam Modak	Synthesis of Nanoporous Materials for Environmental Remediation
3.	25/01/2018	Dr. Swapan Ghosh	Very Core of Indian Climatic Conditions Set The True Benefits of Nanotechnology in Coating Business
4.	11/01/2018	Dr. Suman Sarkar	Development of Novel Materials Through Micro Structural Engineering

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