



Barnali Ghosh (Saha)

Scientist-E (Technical Cell)
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Dr. Barnali Ghosh (Saha) received her Ph.D. from University of Kalyani. She did her postdoctoral work at IISC Bangalore, and then joined at Satyendra Nath Bose National Centre for Basic Sciences in 2004 as a visiting Faculty Fellow and also as a scientist under Women Scientist Scheme (DST sponsored). On February, 2011, she has joined as Research Scientist (Scientist-D) at Satyendra Nath Bose National Centre For Basic Sciences. Now she is working as Scientist-E, since August 2013 at this centre. She is also associated with Technical Research Centre Project as associate Nodal Officer. Her research interest is Physics of Complex oxide systems and in nano materials.

Supervision of Research / Students

Ph.D. Students

1. Subarna Datta (submitting July 2017)
2. Samik Roy Moulik (part time) (will submit soon)
3. Chandan Samanta (Ongoing)
4. Avisek Maity (Ongoing)

Post Doctoral Research Scientists

1. Ankita Ghatak (National Post Doctoral Fellow, SERB)

Teaching activities at the Centre

1. PHY391, "Methods of experimental physics", Third Semester Course", shared with Prof. A.K.Raychaudhuri

Publications in Journals

1. Subarna Datta, Ankita Ghatak and **Barnali Ghosh**; *Manganite ($La_{1-x}A_xMnO_3$; $A = Sr, Ca$) nanowires with adaptable stoichiometry grown by hydrothermal method: understanding of growth mechanism using spatially resolved techniques*; J Mater Sci.; 2016; **51**; 9679.
2. Samik Roy Moulik, Ankita Ghatak, **Barnali Ghosh**; *Study of surface chemistry and microstructure of TiO_2 nanostructures on Pt(111)/Si wafer and FTO glass substrates: A comparative approach*; Surface Science; 2016; **651**; 175-181.
3. Abhijit Maity, Mithun Pal, Sanchi Maithani, **Barnali Ghosh**, Sujit Chaudhuri and Manik Pradhan; *Molecular hydrogen in human breath: a new strategy for selectively diagnosing peptic ulcer disease, non-ulcerous dyspepsia and Helicobacter pylori infection*; Journal of Breath Research; 2016; **10**; 036007.

Lectures Delivered

1. Special seminars organized by the Department of Physics, Lady Brabourne College in April 8, 2016, two lectures.
2. BIT's 5th Annual World Congress of Advanced Materials-2016 (WCAM-2016), on 6-8, June, 2016 in Chongqing, China, one lecture.
3. National Conference on Condensed Matter Physics-2017, Indian Statistical Institute, Kolkata, 1 -3 February, 2017, two lectures.

Other Academic / Educational Activities

1. National Science day program: On 28.2.17, National Science Day celebration, total 120 number of students from various Colleges and University visited our sophisticated instruments like, X-Ray Diffractometer, Scanning Electron Microscope, VSM, Atomic Force Microscope, 1000 class clean room along with various lithographic facilities, under Central Equipment Facilities, Technical Cell. Students from Lady Brabourne College, Presidency University, Narendrapur Ramkrishna Mission, Serampore Girls college visited laboratories.
2. C.K. Majumdar Workshop: 30 number of participants in C. K. Majumdar Memorial Summer Workshop (during 23 May-02 June, 2017, at S. N. Bose Centre had visited and performed hands on experiments on X-ray diffraction, Scanning Electron Microscope, VSM and Atomic Force microscope laboratories for 4 days, during 29 May-01 June, 2017. They have performed experiments successfully.
3. Special lecture on fabrication of nanostructures and various lithographic techniques using various sophisticated tools was delivered at Lady Brabourne College, Kolkata (during April 2016), 40 students (graduate and post graduate) attended the seminar.
4. Special lectures on tuning of size and shape, morphology tailoring issues of different nanostructures and making of devices with single nanowires using different lithographic techniques and their measurements was

given in the Laboratory for Manufacturing System Engineering School of Mechanical Engineering, Xi'an Jiaotong University, Xi'an, Shaanxi, China, June 2016.

Membership of Committees

Internal Committee

Various committees related to Technical cell; Various purchase committees; Associate Nodal Officer, Technical Research Centre.

Patent/s submitted / granted

1. Ammonia Gas Sensor and a method for manufacturing the same; Avisek Maity, Arup Kumar Raychaudhuri, Barnali Ghosh; Application no: 201731000270; Patent filed: 3/01/2017; Published online: 10/02/17.

Fellow / Member of Professional Body

1. Indian Physics Association
2. Indian Association for the Cultivation of Science

Referee of journals:

1. Journal of Material Science and Engineering B
2. Journal of Applied Physics
3. Solid State Communications
4. Journal of Alloys and Compounds
5. Journal of Physics and Chemistry of Solids
6. Journal of Materials

Significant research output / development during last one year

General research areas and problems worked on

Part A: Technology development based research

- Environment related issue: Making of sensor for Hazardas gas detection
- Health Care Sector: Technology development for making device for detection of disease.

Part B: Basic Research:

- Growth of high performance thin film transistors (TFT) and physical property study
- Growth and physical property study of perovskite lead halide
- Synchrotron X-ray and Neutron diffraction study in complex oxides.
- Growth of binary and complex oxide nanowires and thin films by using different techniques like; wet chemistry and pulsed laser deposition methods.
- Fabrication of single nanowire device of complex oxide systems by using different lithographic techniques and transport measurement on single nanowire.

- cross-sectional TEM study in binary and complex oxide nanowires, nanocrystals and thin films
- Study of Photoresponse and gas sensing property in binary oxide systems.

Interesting results obtained

The nature of work has two distinct regions:

- a) Academic nature: Research activities along with Ph.D students under CMPMS department and Technology Research Centre (TRC)
- b) Administrative nature: Handling central equipment facilities under Technical Cell as Scientist I/C of the cell

a) Academic work:

Part A: Technology development based Research:

1. Hazardas Gas like Ammonia detection down <10ppm level from atmosphere based on visual colour change without any other peripherals. Test system developed for proof of concept (Patent filed, Ref. "Patent/s submitted / granted" section)

Part B: Basic Research:

1. Fabrication thin film transistor (TFT) on a flexible substrate using polymer electrolyte as gate dielectric with oxide semiconductor channel: Present work is related to the field of flexible semiconductor devices using electrolyte as gate dielectric. More specifically, the present invention is directed towards development of flexible thin Film Transistor (Flex-TFT) with nanostructure/polycrystalline/amorphous oxide semiconductors as a channel material, which has been fabricated at low temperature retaining high channel mobility. The flexible Thin Film Transistor (Flex-TFT) that uses electrolyte as gate dielectric is adapted to operate at very low voltage, which will allow its operation to be supported by any low voltage source such as a battery. This would make it particularly suitable for use in any mobile and wireless electronic platforms having limited power/voltage source. Fabrication of oxide semiconductor channel was done by using wet chemistry and by pulsed laser Deposition technique and making the device done by optical lithography technique. (patent filed and paper submitted)
2. Surface chemistry and microstructural study of binary oxide vertically aligned nanostructures on different substrates: study of surface and interfaces: The thin film and nanowire of complex and binary oxides grown by Pulsed laser deposition and wet chemistry route. The cross section of the film has been done by focused ion beam assisted lithography technique. A precise electron microscopy analysis i.e, structural simulation by Java Electron Microscopy Software (JEMS) which provides knowledge on growth direction, epitaxy of the materials with respect to the substrate and simulation of the data for understanding the physical property at the interface.

Finally, the physical properties in terms of the interface of the multilayered materials be done (paper published).

3. Understanding of growth mechanism in perovskite oxide nanostructures and size, shape tailoring issues: We report an investigation to understand the basic growth mechanism of family of perovskite oxide manganese nanostructures in cost-effective hydrothermal route, which adds a new dimension in the low-temperature range (230–300°C) synthesis route of complex oxide system. We adapt size, shape, and composition control issues, the general principle of growth of nanocrystals and its controllable length scale tailoring are explained and most importantly, how the amount of mineralizer tunes the shape and size of the nanostructures has been discussed. Mechanism of shape and size tuning followed by a phase diagram has been proposed. Understanding of detailed interaction mechanisms of perovskite oxide manganese is definitely promising for rationally designing various kinds of inorganic materials in controllable length scale via wet chemistry route. (paper published)
4. Electrical transport measurement of single nanowire based devices of complex oxides: Along with the study on ensemble of nanowires where size dispersion issues may arise, we have explored single nanowire based transport measurement to resolve the size dispersion issues and also performed single nanowire 1/f noise spectroscopy study with the aim to understand magnetic phase separation in manganese system. The single nanowire based device of complex oxide nanowires was made by using electron beam and ion beam lithography and transport measurement by using four probe technique.

b) Administrative work:

Work done other than research activities: As a Scientist in-charge of Technical cell, I have to be actively involved in the instrumental facility management and equipment installation. (Ref. "Any Other matter" section below)

Proposed research activities for the coming year

Part A: Technology development based Research:

1. Development of the visual hazardous gas sensor into a proof of concept demonstration product; Making design of low cost product
2. Use of ion beam for inspection of faulty VLSI: Work has already been initiated. It has potential as a revenue earner

Part B: Basic Research

1. Regeneration of ferroelectric phase by surface and sub-surface engineering of perovskite oxide thin films: Details growth and surface and interfacing properties of complex oxide thin films would be done to understand the exact cause of degradation of ferroelectric and dielectric properties of a ferroelectric materials by

complete analysis by number of tools, the work will provide in-depth knowledge about the tuning of physical properties of a dielectric system.

2. Crystallographic structural study using synchrotron and Neutron diffraction experiments: Size reduction induced modification of magnetic property leading to phase separation and its correlation with crystallographic structure in 1D nanostructures of complex oxide systems would be studied by synchrotron and Neutron diffraction experiments
3. Growth and physical property study of perovskite lead halide thin films and nanostructures: Growth of perovskite halide is being done by using wet chemistry route, understanding of physical properties will be done in details.
4. Size induced transport properties in complex oxide nanostructures: The transport properties of single nanowires of different diameters will be measured by making devices using ion beam and e-beam lithographic techniques.

Any other matter

50% of time spent for facility management, 50% time for academic work

Facility management related issue:

Scientist In-charge of Technical cell:

Technical cell: All the major instrumental facilities at our centre are under Technical cell, which looks after the overall running of the facilities. Technical Cell functions as a section and I am Scientist in-charge of the Cell. I/C of Technical Cell act as head of the section.

The major activity comes under the sections the following:

1. Maintenance of equipments;
2. Purchase and installation of new instruments;
3. Up-gradation of existing instruments under Technical cell;
4. Have to supervise smooth inflow of consumables and supplies that is needed for smooth running of the facility;
5. Also involved in the appointment and job allotment of Technical staffs associated with Technical Cell.

As the major instruments are central facility instrument of S.N Bose centre, the users are mainly internal users but we have 20% of the available time for external users also on payment basis. Thirty two universities/institutes/ colleges from different parts of India, uses our central equipment facilities.

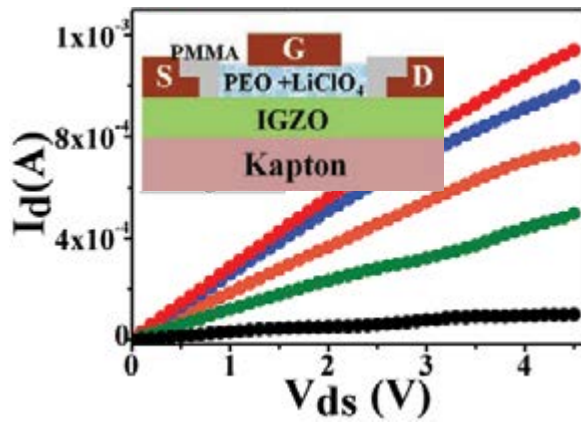


Fig 1. Schematic diagram of the cross section of a flexible TFT device (inset), Typical output characteristics of the device.

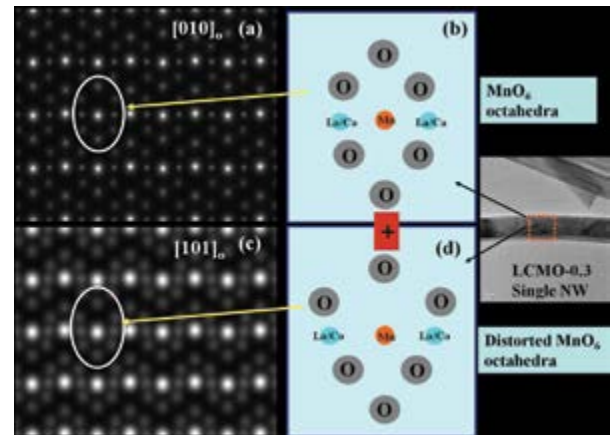


Figure 2. Generated HREM maps of manganite nanowire along the zone axis $[010]_o$ and $[101]_o$; respectively, showing the atomic co-ordinations. b and d, showing distortions in the MnO_6 octahedra confirming the presence of twins.