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**Highlights of his / her research ( not more than 100 words) .....**

B. Bhowmik mainly focusing on Solid State Chemical Sensor/Electron Devices and Nanoelectronics which are related to (i) synthesis of different dimensional (0D, 1D, 2D and 3D) nanostructure of  $TiO_2$  (ii) Modelling and fabrication of device structure like resistive, MIM, MIS, Hetero junction and TFT for sensing application. B. Bhowmik is recently involved with research on novel metal oxide nanomaterials: an alternative source of energy for smarter world.

Representative best pictures/ plot/graph with proper heading : 2 - 4 nos.

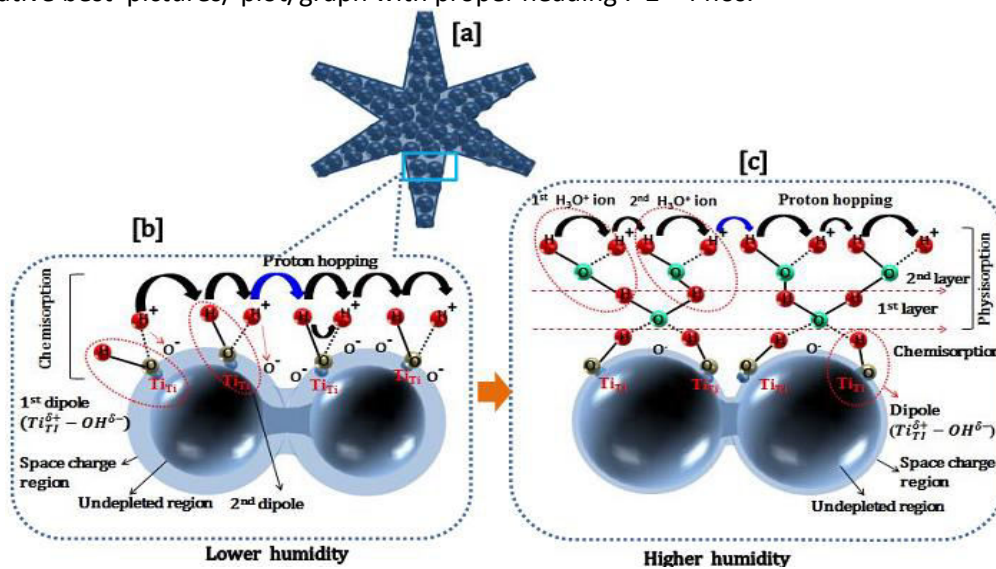


Fig 1. Proton hopping model

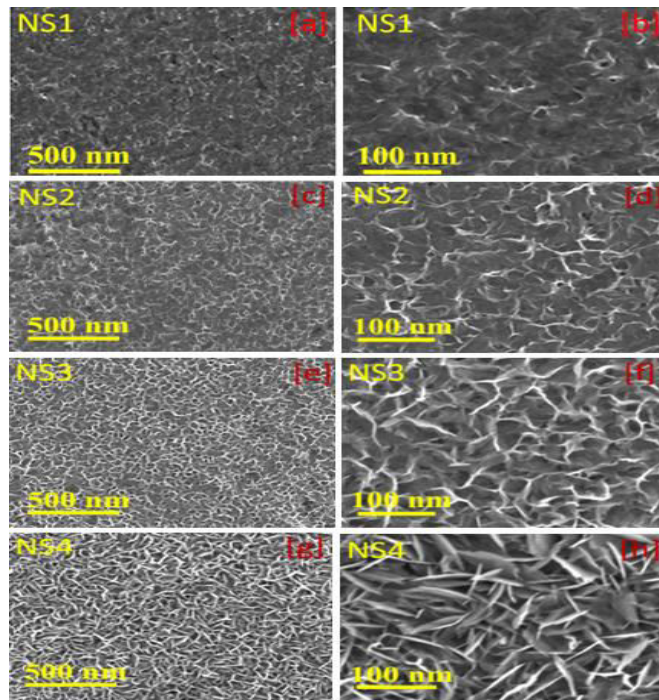


Fig 2. Evolution of  $\text{TiO}_2$  Nanosheet

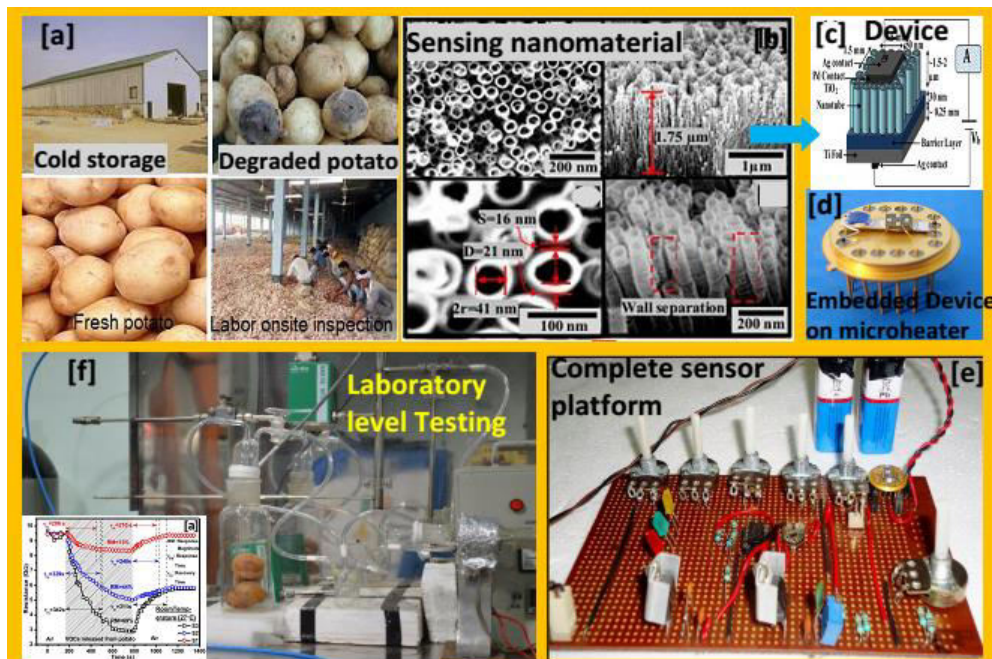


Fig 3. Demonstration of standalone complete sensor system package

**Publications:**

*Book/Book Chapter/Monograph:*

1. Book Chapter: P. Bhattacharyya, **B. Bhowmik**, A. Hazra, P.P. Chattopadhyay, Potentiality of semiconducting metal oxide nanoforms as solid state vapor sensors, in the book 'Sensing Technology: Current Status and Future Trends IV', Edited by Alex Mason, Subhas Chandra Mukhopadhyay, P. Krishanthi Jayasundera, **Springer**, UK (2015).

### PhD work related referred journal papers

1. **B. Bhowmik** and P. Bhattacharyya, A Proton Hopping Guided 3-D Space Charge Model for Quantitative Understanding of Humidity Dependent Gas Sensing by TiO<sub>2</sub> Nanoflower based Devices, *IEEE Transactions on Nanotechnology*, 2016, , (**Impact factor: 1.825**) (Accepted, In press)
2. **B. Bhowmik**, A. Hazra, K. Dutta, P. Bhattacharyya, Repeatability and Stability of Room Temperature Acetone Sensor based on TiO<sub>2</sub> Nanotubes: Influence of Stoichiometry Variation, *IEEE Transactions on Device and Materials Reliability (IEEE)*, vol. 14, no.1, pp. 961-967, 2014 (**Impact factor: 1.89**).
3. **B. Bhowmik**, H.-J. Fecht, P. Bhattacharyya, Vertical Mode Optimal Acetone Sensing Performance of TiO<sub>2</sub> Nanotube array by Tuning of Surface Area and Carrier Transport Time via Nanotube Length Variation, *IEEE Sensor Journal (IEEE)*, vol. 15, no.10, pp.5919-5926, 29, 2015 (**Impact factor 1.762**).
4. **B. Bhowmik**, V. Manjuladevi, R. K. Gupta, P. Bhattacharyya, Highly Selective Low Temperature Acetone Sensor based on Hierarchical 3-D TiO<sub>2</sub> Nanoflowers, *IEEE Sensor Journal (IEEE)*, vol. 16, pp. 3488-3495, 2016 (**Impact factor 1.762**).
5. **B. Bhowmik**, K. Dutta, A. Hazra, P. Bhattacharyya, Low Temperature Acetone Detection by p-type Nanocrystalline TiO<sub>2</sub> Thin Film: Equivalent Circuit Model and Sensing Mechanism, *Solid State Electronics* (Elsevier), vol. 99, pp. 84-92, 2014, (**Impact factor: 1.504**).
6. **B. Bhowmik** and P. Bhattacharyya, Highly Stable Low Temperature Alcohol Sensor Based on Hydrothermally Grown Tetragonal Titania Nanorods, *RSC Advances (RSC)*, vol. 5, pp. 82159-82168, 28, 2015 (**Impact factor 3.8**).
7. P. Bhattacharyya, **B. Bhowmik**, H. J. Fetch, Operating Temperature, Selectivity and Repeatability of TiO<sub>2</sub> Nanotube based Acetone Sensor: Influence of Pd and Ni nanoparticle Modifications, *IEEE Transactions on Devices and Materials Reliability(IEEE)*, vol 14. no. 1, pp. 187-195, 2015 (**Impact factor: 1.89**).
8. **B. Bhowmik** and P. Bhattacharyya, Efficient Gas Sensor Devices based on Surface Engineered Oxygen Vacancy Controlled TiO<sub>2</sub> Nanosheets, *IEEE Transactions on Electron Devices (IEEE)*, 2016, , (**Impact factor: 2.7**) (Under review)

### Associated work during PhD work (referred journals)

9. A. Hazra, K. Dutta, B. **Bhowmik**, P.P. Chattopadhyay, P. Bhattacharyya, Room Temperature Alcohol Sensing by Stoichiometry Controlled TiO<sub>2</sub> Nanotube Array, *Applied Physics Letter(AIP)*, vol. 105, pp. 081604-081607, 2014, (**Impact Factor: 3.302**).
10. A. Hazra, B. **Bhowmik**, K. Dutta, P.P. Chattopadhyay, P. Bhattacharyya, Stoichiometry, Length, and Wall Thickness Optimization of TiO<sub>2</sub> Nanotube Array for Efficient Alcohol Sensing, *ACS Appl. Mater. Interfaces(ACS)*, vol. 7, pp.9336–9348, 2015 (**Impact factor 6.723**).
11. A. Hazra, B. **Bhowmik**, K. Dutta, V. Manjuladevi, R. K. Gupta, P. P. Chattopadhyay, P. Bhattacharyya, Formation Mechanism of Anodically Grown Free-Standing TiO<sub>2</sub> Nanotube Array under the Influence of Mixed Electrolytes, *Science of Advance Material (ASP)*, vol. 6, pp. 714-719, 2014 (**Impact factor: 2.598**).
12. N. Banerjee, B. **Bhowmik**, S. Sarkar, C. K. Sarkar, P. Bhattacharyya, Anomalous Recovery Characteristics of Pd Modified ZnO Nanorod based Acetone Sensor, *Journal of Nanoscience and Nanotechnology(ASP)*, vol 13, pp.1-8, 2013 (**Impact factor: 1.5**).
13. K. Dutta, B. **Bhowmik**, A. Hazra, P. P. Chattopadhyay, P. Bhattacharyya, An efficient BTX Sensor Based on p-type Nanoporous Titania Thin Films, *Microelectronics Reliability (Elsevier)*, vol. 55, pp. 558–564, 2015 (**Impact Factor: 1.433**).
14. A. Hazra, K. Dutta, B. **Bhowmik**, P. Bhattacharyya, Highly Repeatable Low-ppm Ethanol Sensing Characteristics of p-TiO<sub>2</sub>-Based Resistive Devices, *IEEE Sensors Journal (IEEE)*, vol. 15, no. 1, pp.408-416, 2015, (**Impact Factor 1.762**).
15. A. Hazra, K. Dutta, B. **Bhowmik**, V. Manjuladevi, R. K. Gupta, P. Bhattacharyya, Low Temperature Methanol Sensing by p-titania: Correlation with Defects States and Schottky Barrier Model, *IEEE Transactions on Nanotechnology(IEEE)*, vol 14. no. 1, pp. 187-195, 2014, (**Impact Factor: 1.825**).
16. A. Hazra, K. Dutta, B. **Bhowmik**, V. Manjuladevi, R. K. Gupta, P. P. Chattopadhyay, P. Bhattacharyya, Structural and Optical Characterizations of Electrochemically Grown Connected and Free-Standing TiO<sub>2</sub> Nanotube Array, *Journal of Electronic Material (Springer)*, vol. 43 (9) pp. 3229-3235, 2014, (**Impact factor: 1.798**).
17. K. Dutta, B. **Bhowmik** and P. Bhattacharyya, Resonant Frequency Tuning Technique for Selective Detection of Alcohols by TiO<sub>2</sub> Nanorod based Capacitive Device, *IEEE Transactions on Nanotechnology(IEEE)*, (**Impact Factor: 1.825**), (Under review)

### PhD work related conference paper

1. **B. Bhowmik**, P.P. Chattopadhyay, H. J. Fecht and P. Bhattacharyya, 1D and 3D nanostructures of TiO<sub>2</sub> as gas sensing element: A Comparative study, 4<sup>th</sup>Nanotoday Conference, Dubai, 6-10<sup>th</sup> December 2015.
2. **B. Bhowmik**, K. Dutta and P. Bhattacharyya, n-TiO<sub>2</sub>/p-Si Heterojunction Devices as a Potential Ethanol Sensor, Conference on Computers and Devices for Communication, Swiss hotel, Kolkata, 16-18<sup>th</sup> 2015.
3. **B. Bhowmik** and P. Bhattacharyya, Development of Efficient Acetone Sensor based on 0-D, 1-D, 2-D and 3-D Nanostructures of TiO<sub>2</sub>, Young Scientist Colloquium-2015, Organized by Materials Research Society of India (Kolkata chapter), CSIR-CGCRI Kolkata, 11<sup>th</sup> Sept 2015.
4. **B. Bhowmik**, A. Hazra, K. Dutta, P. Bhattacharyya, Nanocrystalline p-TiO<sub>2</sub> based MIS Device for Efficient Acetone Detection, *IEEE SENSORS 2014*, vol., no., pp.293,296, Valencia, Spain, 2-5 Nov. 2014
5. **B. Bhowmik**, A. Hazra, K. Dutta, P. Bhattacharyya, Development of Pd/TiO<sub>2</sub>/Si MIS Ethanol Sensor using Nano-TiO<sub>2</sub> Sensing Layer, *International Union of Material Research Society-International Conference in India 2013*, IISc Bangalore, India, 16- 20<sup>th</sup> December, 2013.
6. **B. Bhowmik**, K. Dutta, N. Banerjee, A. Hazra, P. Bhattacharyya, Low Temperature Acetone Sensor Based on Sol-gel Grown Nano TiO<sub>2</sub>Thin Film, International Conference on Emerging Trends in Computing, Communication and Nanotechnology (ICE-CCN), 2013, vol., no., pp.553,557, Tutikorin, Tamilnadu, 25-26<sup>th</sup> March 2013 doi: 10.1109/ICE-CCN.2013.6528561

### Associated work during PhD work

7. S. Ghosal, **B. Bhowmik** and P. Bhattacharyya, Low temperature ethanol sensing performance of hydrothermally grown TiO<sub>2</sub> nanoflowers in resistive mode, 4<sup>th</sup>Nanotoday Conference, Dubai, 6-10<sup>th</sup> December 2015.
8. K. Dutta, **B. Bhowmik**, P. P. Chattopadhyay and P. Bhattacharyya, Titania Nanotube based Xylene Sensor; Influence of Anodization Voltage, Conference on Computers and Devices for Communication, Swiss hotel, Kolkata, 16-18<sup>th</sup> 2015.
9. A. Hazra, **B. Bhowmik**, K. Dutta, P. Bhattacharyya, Low Temperature Low ppm Acetone Detection by Pd/TiO<sub>2</sub>/p-Si Metal-Insulator-Semiconductor Devices, 7<sup>th</sup> International Conference on Sensing Technology (ICST 2013)Wellington, New Zealand 3-5<sup>th</sup> Dec 2013, pp-396-400

10. A. Hazra, **B. Bhowmik**, K. Dutta, P. Bhattacharyya, Sol-gel Derived Nanocrystalline Undoped p-TiO<sub>2</sub> Thin Film: Structural, Optical and MIS Device Characteristics, International Union of Material Research Society-International Conference in India 2013, IISc Bangalore, India, 16- 20<sup>th</sup> December, 2013.
11. K. Dutta, A. Hazra, **B. Bhowmik**, P.P. Chattopadhyay, P. Bhattacharyya, Mixed Electrolyte: A Controllable Route for Achieving Better Aspect Ratio of TiO<sub>2</sub> Nanotubes, International Union of Material Research Society-International Conference in India 2013, IISc Bangalore, India, 16- 20<sup>th</sup> December, 2013.
12. P. Bhattacharyya, A. Hazra, **B. Bhowmik**, K. Dutta, Effect of Stoichiometry variation on Alcohol Sensing Properties of Electrochemically Grown TiO<sub>2</sub> Nanotubes, 30<sup>th</sup> European Conference on Surface Science, Antalya, Turkey, 31<sup>st</sup> Aug-5<sup>th</sup> Sep 2014
13. K. Dutta, B. Bhowmik and P. Bhattacharyya, Resonant frequency tuning technique for selective detection of alcohols by TiO<sub>2</sub> nanorod based capacitive device, 9-12 October, Toulouse, France, NMDC-2016