

List of Publications of IC Design and Fabrication Center

[A] Pressure Sensor

Journal Papers:

- [1]: "Piezoresistive pressure sensing by porous Silicon Membrane", **C.Pramanik**, H.Saha, *IEEE Sensors*, vol.6, pp.301-309 (2006).
- [2]: "An Integrated Pressure and Temperature Sensor Based on Nanocrystalline Porous Silicon", **C.Pramanik**, U.Gangopadhyay, H.Saha, *Journal of Micromechanics and Microengineering (IOP)*, vol.16,p.29(2006).
- [3]: "Design optimization of a high performance silicon MEMS piezoresistive pressure sensor for biomedical applications", **C.Pramanik**, H.Saha, U.Gangopadhyay, *Journal of Micromechanics and Microengineering*, vol.16, pp.2060-2066(2006).
- [4]: "Piezoresistivity of Nanocrystalline Silicon", **C.Pramanik**, S.Banerjee, H.Saha and C.K.Sarkar, *Nanotechnology Journal*,vol.17, p.3209(2006).
- [5]: "Low pressure piezoresistive pressure sensors for biomedical applications", **C.Pramanik**, H.Saha *Materials and Manufacturing Processes*, vol.21(3), p.233-238(2006).
- [6]: "Improved Contacts On Porous Silicon Layer By Electroless Nickel Plating and Copper Thickening", J.Kanungo, **C.Pramanik**, S.Bandopadhyay, U.Gangopadhyay, L.Das, H.Saha, R.T.T.Gettens, *Semiconductor Science and Technology (IOP)*, vol.21,pp.964-970 (2006).
- [7]: "Temperature compensation of porous silicon piezoresistive pressure sensor using ANN", **C.Pramanik**, T.Islam, H.Saha, *Microelectronics Reliability*, vol.46, pp.343-351 (2006).

- [8]: "Porous Silicon Based Sensors: Prospects and Challenges", H.Saha, **C.Pramanik** to be published in *Materials and Manufacturing Processes* (Marcel Dekker), vol.21(2006).
- [9]: "Impact of self heating in a silicon MEMS piezoresistive pressure sensor", **C.Pramanik**, T.Islam, H.Saha, *Sensor Letters*, vol.2, pp.131-137 (2004).

Conference papers:

- [1]: "Design, Modeling and Simulation of Porous Silicon Pressure Sensor", H.Saha, A.K.Pal, **C.Pramanik**, J.Das, *V DAT Proc.* pp.418-425 (2002).
- [2]: "Porous silicon device modeling and linearisation technique", S.Pandit, A.Adhya, **C.Pramanik**, H.Saha, *Proc. of IEEE Conference on Electron Devices and Solid State circuits*, Hong Kong (2003), p.141
- [3]: "Silicon/ Porous Silicon MEMS Piezoresistive Pressure sensor: An alternative design for increased sensitivity", **C.Pramanik**, H.Saha, *Proc. of IWPSD at IIT Chennai* (2003), pp.710-712.
- [4]: "Porous Silicon as Pressure sensing material", **C.Pramanik**, U.Gangopadhyay, J.Yi, H.Saha, accepted for oral presentation in *Porous Semiconductors Science and Technology* (PSST-2004), Spain.
- [5]: "An integrated pressure and temperature sensor based on porous silicon", H.Saha, **C.Pramanik**, U.Gangopadhyay, accepted for oral presentation at *IEEE Sensors conference 2004*, Vienna (Austin).
- [6]: "Low pressure piezoresistive pressure sensors for biomedical applications", **C.Pramanik**, H.Saha accepted for oral presentation in *International Seminar on Advanced Materials and processing ISAMAP 2004, IITKGP*.
- [7]: "Smart Sensor System–on-chip Design With Porous Silicon MEMS Transducer", H.Saha and **C.Pramanik**, *Proc. of All India Seminar on Recent Advances in VLSI*, 21st and 22nd Feb. (2004) pp. 37-46.

- [8]: "Design, Fabrication, Testing and Simulation of Porous Silicon Based Smart MEMS Pressure Sensor", **C. Pramanik**, T. Islam, H. Saha, J. Bhattacharya, S. Banerjee, S. Dey, *18th International Conference on VLSI Design held jointly with 4th International Conference on Embedded Systems Design (VLSID'05)*, pp. 235-240.
- [9]: "Design, Fabrication and Testing of Nanocrystalline Porous Silicon Based Smart MEMS Pressure Sensors", **C.Pramanik**, T. Islam D. Chatterjee, S. Saha and H. Saha, *International Conference on MEMS and Semiconductor Nanotechnology*, IIT KGP, Dec. 2005.
- [10]: "Design, Modeling and Simulation of Nanocrystalline Porous Silicon Based MEMS Pressure Sensor", **C.Pramanik**, S. Banerjee and H. Saha, *4th International Conference on Smart Materials, Structures and Systems (IISc Bangalore)*, p. SE159, July 28-30(2005).
- [11]: "High performance piezoresistive pressure sensor based on nanocrystalline silicon", **Chirasree Pramanik**, Sumitra Bandopadhyay, Utpal Gangopadhyay and Hiranmay Saha, accepted in *8th International Conference on Nanostructured Materials Nano 2006*(August 2006, IISc Bangalore).
- [12]: "Development of SPICE Compatible Thermal Model of Silicon MEMS Piezoresistive Pressure Sensor for CMOS- MEMS Integration", **C.Pramanik**, S. Banerjee, D. Mukherjee, H. Saha, *IEEE Sensors conference 2006* held at Daegu, Korea(22nd October to 25th October 2006).
- [12] Porous silicon-metallic nickel contact, J. Kanungo, S. Bandopadhyay, U. gangopadhyay, H. Saha, 13th state Science Congress

[B] Gas Sensor

Journal

- [1] "Fast Response Methane Sensor based on Pd (Ag)/ZnO/Zn MIM Structure " by **P. Bhattacharyya**, P. K. Basu, H. Saha and S. Basu, **Sensor Letters**(2006), Vol-4, p1-6
- [2] "Galvanic Deposition of Nanocrystalline ZnO Thin Films From a ZnO-Zn(OH)₂ Mixed Phase Precursor on p-Si Substrate " by N. Mukherjee, **P. Bhattacharyya**,

Conference papers-

- [1] “ Design of the optimum microheater for smart MEMS gas sensor” by
Partha Bhattacharyya, Shreyash Sen ,Avhishek Chatterjee and Hiranmay Saha
In Proceedings of ISSS 2005 **International Conference** on Smart Materials
Structures and Systems July 28-30, 2005, Bangalore, India
- [2] ”MEMS based Nanocrystalline metal oxide gas sensors for coal mine environment”
by **P.Bhattacharyya**, S.Sen,a.Chatterjee,S.Das,K.Basu,A.Pal and H.Saha
In Proceedings of MEMSNANO- 2005 **International Conference** on MEMS and
Semiconductor Nanotechnology December 20-22, 2005, IIT Kharagpur, India
- [3] “Nanocrystalline ZnO thin films for MEMS based Gas Sensors” by
P. Bhattacharyya, P.K.Basu, S.Basu and H.Saha
International Conference on Recent Trends in Nanoscience & Technology –2006
(ICRTNT-06), 7-9th DEC, 2006
- [4] “A Novel Micromachined Pd (Ag)/ZnO/Zn MIM Methane Sensor” by
P. Bhattacharyya, P.K.Basu,U.Gangopadhyay, H.Saha and S.Basu
National Conference on Sensors and Actuators:Emerging Technological
Challenges (NCSA-2006), 21-22 December,2006,CGCRI,Kolkata
- [5] “Formation and characterization of uniform nanostructured porous silicon”
P.Bhattacharyya, S. Ghosh, S. Chakrabarty, H. Saha
International Conference on Nano-Materials: synthesis
Characterization and Application: (Nano-2004-India) Kolkata, India 4-6 November
2004 **Organized by** : IE India, BECS,MRSI,UNSW and UCF
- [6] ” ZnO Based Sensor for Methane Detection “
by **P. Bhattacharyya**, S.Basu and H. Saha **National Seminar** on Physics and
Technology of Sensors(NSPTS-11)

27th Feb to 1st March,2006,University of Pune, Pune, India

- [7] “Role of nanostructured materials for MEMS based gas sensor”
Perth Bhattacharya, Rajdeep Adhikary , ,H.Saha, Sukumar Basu
National Conference on Nano-Science and Technology
Organised by Centre for Nano-Science and Technology
Jadavpur University,Kolkata,India January21,2005
- [8] Wireless Communication in underground coalmines
P.Bhattacharyya, S.Boral, P.Mukhopadhyay, S.Chakrabarty and H.saha
EFCoS-2005 (Emerging &Futuristic Communication System)
(36th mid term symposium and exhibition) 30April-1May(2005)
IISc,Bangalore.India
- [9] ” Zinc Oxide based Gas Sensor array with Signal Processing and Wireless
Communication unit for monitoring hazardous gases in Coal mine environment
” by S.Boral,**P.Bhattacharyya**,P.Mukherjee and H.Saha
EPMDS-2006
International Conference on electronic and Photonic materials,Devices and Systems
4-6 January-2006,Kolkata,India
- [10]”Smart wireless Sensor Network in Underground Coalmines”
by P.Mukherjee,S.Boral,**P.Bhattacharyya** and H.Saha
4th Asian **International** mobile computing Conference,
4-7 Jan, 2006,Kolkata,India
- [11] “Quantitative analysis Of Reaction Rate Of Porous Nano Crystalline Metal Oxide
Based Gas Sensors “ by S.Das , A.Pal , S.Basu , **P.Bhattacharya** and H.Saha
8th **International conference** on Nanostructures Materials (NANO2006.)
August 20-25,2006,IISc, Bangalore

[C] Humidity and Vapour Sensor

Journal Papers:

[1] **T. Islam**, S. Ghose, H. Saha. ANN- based signal conditioning and its hardware implementation of a nanostructured porous silicon relative humidity sensor, International journal of Sensors and Actuators B 120/1 (2006) 130-141.

[2] **T. Islam**, H. Saha, Study of long-term drift of a porous silicon humidity sensor and its compensation using ANN technique, International journal of Sensors and Actuators A (2006) available on line in corrected proof.

[3] **T. Islam**, H. Saha. Hysteresis compensation of a porous silicon relative humidity sensor using ANN technique, International journal of Sensors and Actuators B 114 (2006) 334-343.

[4] **T. Islam**, C. Pramanik, H. Saha, Modeling, simulation and temperature compensation of porous polysilicon capacitive humidity sensor using ANN technique, International journal of Microelectronics Reliability 45 (2005) 697-703.

[5] **T. Islam**, K.K. Mistry, K. Sengupta, H. Saha, Measurement of gas moisture in the ppm range by porous silicon (PS) and porous alumina sensors, International journal of Sensors and Materials 16 (7) (2004) 345-356.

[6] **T. Islam**, H. Saha, Development of active bridge technique for measuring low capacitance over wide frequency range, National Journal of Education (IETE) 46 (1) (2005) 19-25.

[7] C. Pramanik, **T. Islam**, H. Saha, Temperature compensation of piezoresistive micromachined porous silicon pressure sensor using ANN, International journal of Microelectronics Reliability 46 (2006) 343-351.

[8] **T. Islam**, S.R. Chaudhury, H. Saha, An ASIC of an integrated signal processing system for compensation short and long-term drift of a porous silicon humidity sensor, International journal of Sensors and Actuators B (2006) **communicated**.

[9] **T. Islam**, H. Saha, Modeling of an aged porous silicon humidity sensor using ANN technique", Sensors & Transducers Journal 72 (10) (2006) 731-739.

Conference Proceedings:

1. **T. Islam**, P.K. Dutta, J. Das, H. Saha, Porous silicon based electronic nose for the detection of organic vapors, International conference on Electronic and Photonic Materials, Devices and Systems (EPMDS-2006) January 4-6 (2006) Kolkata, India.
1. **T. Islam**, P.K.Dutta, J. Das, H. Saha, Signal conditioning of porous silicon based organic vapor sensor array, 11th National Seminar on Physics and Technology of Sensors (NSPTS-11), February 27-1 March. (2006) Pune, India.
2. **T. Islam**, H. Saha, Nonlinearity compensation of a nanostructured porous silicon based humidity sensor using ANN technique, 11th National Seminar on Physics and Technology of Sensors (NSPTS-11), February 27-1 March. (2006) Pune, India.
3. **T. Islam**, J Das, H. Saha, Porous silicon based organic vapor sensor array for e-nose applications, 5th International Conference on Sensors, October 22-25 (2006) Daegu, Korea.
4. S.M. Hossain, J. Das, **T. Islam**, H. Saha, Vapor detection using porous silicon sensor array, 11th International Meetings on chemical sensors (IMCS11), July 16-19 (2006) University of Brescia, Brescia, Itali.
5. **T. Islam**, H. Saha, Modeling and simulation of a porous silicon capacitive humidity sensor using ANN technique for smart sensor application, International Conference on Smart Materials and Structures (ISSS-05) July 28-30 (2005) IISc. Bangalore, India.
6. **T. Islam**, H. Saha, A precision digital ppm level gas moisture detector with porous sensor, International Conference ISAMAP2K4, December 6-8 (2004) Material Science Department, IIT Kharagpur, India.

7. C. Pramanik, **T. Islam**, H. Saha, J. Bhattacharya, S. Banerjee, S. Dey, Design, fabrication and simulation of porous silicon based smart MEMS pressure sensor, VLSI Design and ICES –4, January 3-7 (2005) Taj Bengal Hotel, Kolkata, India.
8. C. Pramanik, **T. Islam**, H. Saha, Temperature estimation and compensation due to self-heating in a silicon based MEMS pressure sensor, International Conference on Communications, Devices and Intelligent System (CODIS-2004), January 8-10 (2004) Park Hotel, Kolkata, India.
9. J. Das, **T. Islam**, S.M. Hossain. H. Saha, Porous silicon based vapor sensor array with neural network, International Workshop on Physics of Semiconductor Devices (IWPSD-2003) December, 16-20 (2003), IIT Chennai, India.
10. **T. Islam**, H. Saha, ANN based pattern recognition for porous silicon (PS) based sensor array for alcohol sensing, National Conference on Sensors and Actuators: Emerging Technological Challenges, NCSA-06, 21-22 December 2006, Central Glass Ceramic Research Institute, Kolkata-700032.

[D] Solar Cell and Photonic Devices

- 1] M. Banerjee, S.K. Dutta, U. Gangopadhyay, D. Majumdar and H. Saha, Modeling and simulation of layer transferred thin silicon solar cell with Quasi Monocrystalline porous silicon (QMPS) as active layer, Solid State Electronics, 49 (2005)1282-1291
 1. “Role of hydrazine monohydrate during texturization of large-area crystalline silicon solar cell fabrication”, **U. Gangopadhyay**, Kyunghae Kim, Ajoy Kandol, Junsin Yi and H. Saha, Solar Energy Materials and Solar Cells, **90**, (2006), Pages 3094-3101.
 2. “A novel low cost texturization method for large area commercial mono-crystalline silicon solar cells” **U. Gangopadhyay**, K.H. Kim, S.K. Dhungel, U. Manna, P.K. Basu, M. Banerjee, H. Saha and Junsin Yi, Solar Energy Materials and Solar Cells, Volume 90, Issue 20, 15 December 2006, Pages 3557-3567

3. "Modeling and simulation of layer-transferred thin silicon solar cell with quasi monocrystalline porous silicon as active layer" M. Banerjee, S.K. Dutta, **U. Gangopadhyay**, D. Majumdar and H. Saha, *Solid-State Electronics*, 49(2005), Pages 1282-1291.
4. "Comparative Study of Different Approaches of Multicrystalline Silicon Texturing for Solar Cell Fabrication", U. Gangopadhyay, S.K. Dhungel, P.K. Basu, S.K. Dutta, H. Saha and J. Yi, Accepted for publication in *Solar Energy Materials & Solar Cells* (2006).
5. "Design optimization of a high performance silicon MEMS piezoresistive pressure sensor for biomedical applications" C Pramanik, H Saha and U Gangopadhyay *J. Micromech. Microeng.* **16**(2006), pages 2060-2066.
6. "Improved contacts on a porous silicon layer by electroless nickel plating and copper thickening", J Kanungo, C Pramanik, S Bandopadhyay, U Gangopadhyay, L Das, H Saha and Robert T T Gettens . *Semicond. Sci. Technol* **21** (2006), pages 964-970.
7. "An integrated pressure and temperature sensor based on Nan crystalline porous silicon" C Pramanik, H Saha and U Gangopadhyay *J. Micromech. Microeng.* **16** (2006), pages 340-348.
8. "Ni-B deposits on p-silicon using borohydride as a reducing agent" Anup Mondal, Sabyashachi Nath, Ashok Mondal, Sikha Bandopadhyay, **Utpal Gangopadhyay** and Hiranmay Saha, *Materials Research Bulletin*, 39, (2004), Pages 2187-2192.
9. "Growth of Ni-B films on n-silicon" Anup Mondal, Sabyashachi Nath, Ashok Mondal, Sikha Bandopadhyay, **Utpal Gangopadhyay**, Hiranmay Saha *physica status solidi (a)* 202,(2005), Pages 1786-1792.
10. "Porous silicon as Pressure Sensing Materials", **U. Gangopadhyay**, C. Pramanik, H. Saha, Kyunghae Kim, J. Yi, *Journal of the Korean Physical Society*, **47** (2005), page S450-s453.

[E] Nanoscience and Nanotechnology

Journal paper:

- 1] M. Banerjee, S.K. Dutta and H. Saha, Enhanced optical absorption in thin silicon layer with nano voids, *Nanotechnology*, 16(2005) 1542-1547.
- 2] M. Banerjee, S.K. Dutta and H. Saha, Carrier Density in Thin Silicon Layer with nano voids, *Nanotechnology*, 17(2006) 163-169.

Conference Papers:

- 1] M. Banerjee, S.M. Hossain, D. Majumder, S.K. Dutta and H. Saha, Thin silicon solar cell by layer transfer process, HOT 2003, Institute of Radio Physics and Electronics, Feb. 8-10, 2003.
- 2] M. Banerjee, D. Majumdar, S.K. Dutta, S.M. Hossain and H. Saha, Quasi Monocrystalline Porous Silicon : a promising active material for solar cell, *Physics of semiconductor devices Vol.2 (Proc. Of 12th International Workshop on Physics of semiconductor devices, IIT Chennai, India, Dec. 16-20, 2003)* pp. 947-949. **(Best Poster Award)**.
- 3] M. Banerjee, D. Majumder, S.K. Datta and H. Saha, Structural and Optical characterization of quasi monocrystalline porous silicon (QMPS) layer of thin solar cell application, *Proc. of CODIS-2004* pg 342-345.
- 4] M. Banerjee, D. Majumdar, U. Gangopadhyay, S.K. Dutta and H. Saha, Potential of Quasi monocrystalline porous silicon (QMPS) layer or thin solar cell application, *Tech. Digest (Vol.1) of 14th International Photovoltaic Science and Engineering conference (PVSEC-14), 26-30 January 2004 (Bangkok, Thailand)* 331-332.

- 5] M.Banerjee, P. Mandal, S.K. Dutta, H. Saha, Thin Silicon Solar Cell with QMPS as active layer: A Few Challenges, National Seminar on Renewable Energy Technologies: Innovations & Market Penetration, 8-9th October, 2004(IACS, Kolkata) 15.
- 6] S.Chakraborty, L. Das, M. Banerjee, S. K. Dutta & H. Saha, Porous Silicon based Optical Sensors, International Symposium on Advanced Materials and Processing, 6th- 8th Dec., 2004,(IIT Kharagpur, India).
- 7] M. Banerjee, S.K.Dutta & H. Saha, Enhanced Optical Absorption in QMPS layer with nano-voids, National seminar on Nano-technology, 21st January,2005,(Jadavpur University, Kolkata).
- 8] U. Gangopadhyay, M. Banerjee, S.K.Dhungel, K.Kim, U.Manna, S.K. Dutta, H.Saha, J. Yi, Thin Silicon Solar Cell Using Quasi Monocrystalline Porous Silicon as active layer, 20th European Photovoltaic Solar Energy Conference, Barcelona, Spain,6-10th June, 2005, pp 390-393.
- 9] M. Banerjee, S.K.Dutta, U. Gangopadhyay & H. Saha, Thin Silicon Solar Cell by Layer Transfer Process Using QMPS as active layer – Challenges & Prospects, abstract accepted for oral presentation, PVSEC-15, 10th-15th October, 2005 (Shanghai, China).

[F] Embedded Systems and VLSI Design

1. Journal Papers:

1. **S. Roy Chowdhury**, H. Saha, “*Development of an FPGA based smart embedded system for rural telediagnostic applications*”, IETE Technical Review, Vol. 23 No. 5, pp 295-301, 2006.

2. Conference Papers:

1. **S.Roy Chowdhury**, C.Pramanik, H.Saha , “*ASIC Design of the linearisation circuit of a PTC thermistor*”, International Conference on VLSI Design and Embedded Systems, Kolkata, January 3-7, 2005.

2. **S. Roy Chowdhury**, S. Neogi, S. Chakrabarti, H. Saha, “*Design of an Ad hoc Network for Cognitive Telemedicine Applications*”, Emerging Futuristic Communication System Symposium, IISc Bangalore, April 29 – May 1, 2005.
3. P. Bhattacharyya, **S. Roy Chowdhury**, S. Boral, P. Mukherjee, P.K. Dutta, S. Chakrabarti, H. Saha, “*Wireless Communication in the Mines*”, Emerging Futuristic Communication System Symposium, IISc Bangalore, April 29 – May 1, 2005.
4. **S. Roy Chowdhury**, H. Saha, “*Design of a Cognitive Ad hoc Network for Embedded Telemedicine Applications*”, Asia South Pacific International Conference on Embedded Systems, IISc Bangalore, July 5-7, 2005.
5. **S. Roy Chowdhury**, H. Saha, “*VHDL Model of a Cognitive System for Telemedicine Applications*”, IEEE VLSI Design and Test Symposium, Bangalore, August 10-13, 2005.
6. **S. Roy Chowdhury**, H. Saha, “*VHDL Modeling and FPGA based implementation of an artificial telediagnostic system*”, IEE-CSI International Conference on emerging areas of Information Technology 2006, Kolkata, February 10-11, 2006.
7. **S. Roy Chowdhury**, H. Saha, “*Development of an FPGA based smart embedded system for rural telediagnostic applications*”, Symposium on Information Communication Technology Initiative for Rural Development 2006, Kolkata, April 07-09, 2006.
8. **S. Roy Chowdhury**, H. Saha, “*Development of an FPGA based artificial diagnostic system and estimation of its reliability*”, Indian Conference on Medical Informatics and Telemedicine 2006, IIT Kharagpur, December 18-20, 2006.
9. **S. Roy Chowdhury**, S. Das, T. Islam, H. Saha, “*ASIC design of an ANN for the Temperature and Drift Compensation of a Humidity Sensor*”, International Conference on International Conference on Computers and Devices for Communication 2006, Kolkata, December 18-20, 2006 .

Book:

H. Saha, S. Dey, C. Pramanik, J. Das, **T. Islam**, Porous silicon based smart sensors, coauthor in a chapter of Encyclopedia of sensors published by American Scientific Publishers (ASP) (2006) [http:// www.aspbs.com/eos](http://www.aspbs.com/eos).