
REFERENCES

- G. A. Burrell, "The use of mice and birds for detecting carbon monoxide after mine fires and explosions," Department of the Interior, Bureau of Mines; 1914.
- W. H. Brattain, and J. Bardeen, "Surface properties of germanium," *The Bell System Technical Journal*, vol. 32, no. 1, pp.1-41, 1953.
- T. Seiyama, A. Kato, K. Fujiishi, and M. Nagatani, "A New Detector for Gaseous Components Using Semiconductive Thin Films," *Anal. Chem.*, vol. 34, pp.1502–3, 1962.
- J. Pascual, J. Camassel, and H. Mathieu, "Fine structure in the intrinsic absorption edge of TiO₂," *Physical Review B*, vol. 18, no. 10, p. 5606, 1978.
- N. Yamazoe, J. Fuchigami, M. Kishikawa, and T. Seiyama, "Interactions of tin oxide surface with O₂, H₂O AND H₂," *Surf. Sci.*, vol. 86, pp. 335–44, 1979.
- N. Yamamoto, S. Tonomura, T. Matsuoka, and H. Tsubomura, "A study on a palladium-titanium oxide Schottky diode as a detector for gaseous components," *Surf. Sci.*, vol. 92, no. 2-3, pp. 400–406, 1980.
- S. Chang, "Oxygen chemisorption on tin oxide: Correlation between electrical conductivity and EPR measurements," *J. Vac. Sci. Technol.*, vol. 17, pp. 366–9, 1980.
- B. E. Deal, "Standardized Terminology for Oxide Charges Associated with Thermally Oxidized Silicon," *IEEE Trans. Electron Devices*, vol. 27, no. 3, pp. 606–608, 1980.
- S. M. Sze, *Physics of Semiconductor Devices*, 2nd ed. New York, USA: Wiley, 1981.
- T. L. Poteat and B. C. Lalevi, "Pd-MOS Hydrogen and Hydrocarbon Sensor Device," *IEEE Electron Device Lett.*, vol. 2, no. 4, pp. 82–84, 1981.
- G. Heiland, "Homogeneous semiconducting gas sensors," *Sensors and Actuators*, vol. 2, pp. 343–361, 1981.
- T. L. Poteat, B. Lalevic., "Transition Metal-Gate MOS Gaseous Detectors," *IEEE Trans. Electron Devices*, vol. 29, no. 1, pp. 123–129, 1982.

- B. Bott, T. A. Jones, and B. Mann, "The detection and measurement of CO using ZnO single crystals," *Sensors and Actuators*, vol. 5, no. 1, pp. 65-73, 1984.
- G. J. Maclay, "MOS hydrogen sensors with ultrathin layers of palladium," *IEEE Trans. Electron Devices*, vol. 32, no. 7, pp. 1158-1164, 1985.
- M. Egashira, N. Kanehara, Y. Shimizu, and H. Iwanaga, "Gas-sensing characteristics of Li+-doped and undoped ZnO whiskers," *Sensors and Actuators*, vol. 18, no. 3-4, pp. 349-360, 1989
- S. Pizzini, N. Butta, D. Narducci, and M. Palladino, "Thick film ZnO resistive gas sensors: analysis of their kinetic behavior," *Journal of the Electrochemical Society*, vol. 136, no. 7, p. 1945, 1989.
- L. Yadava, R. Dwivedi, S.K. Srivastava., "A titanium dioxide-based MOS hydrogen sensor," *Solid State Electron.*, vol. 33, no. 10, pp. 1229-1234, 1990.
- K. D. Schierbaum, U. K. Kirner, J. F. Geiger, and W. Göpel, "Schottky-barrier and conductivity gas sensors based upon Pd/SnO₂ and Pt/TiO₂," *Sensors and Actuators B: Chemical*, vol. 4, no. 1-2, pp. 87-94, 1991.
- A. R. Raju, and C. N. R. Rao, "Gas-sensing characteristics of ZnO and copper-impregnated ZnO," *Sensors and Actuators B: Chemical*, vol. 3, no. 4, pp. 305-310, 1991.
- I. M. Thomas, "Sol-gel coatings for high-power laser optics: Past, present and future," *Laser-Induced Damage in Optical Materials*, Vol. 2114, pp. 232-243, 1993.
- V. E. Henrich, and P. A. Cox, "The surface chemistry of metal oxides", 1994.
- National Research Council, "Expanding the vision of sensor materials,". National Academies Press; 1995 Jul 6.
- A. Amtout, and R. Leonelli, "Optical properties of rutile near its fundamental band gap," *Physical Review B*, vol. 51, no. 11, pp. 6842, 1995.
- H. Tang, F. Levy, H. Berger, and P. E. Schmid, "Urbach tail of anatase TiO₂," *Physical Review B*, vol. 52, no. 11, p. 7771, 1995.
- G. Sberveglieri, "Recent developments in semiconducting thin-film gas sensors," *Sensors Actuators B Chem.*, vol. 23, no. 2-3, pp. 103-109, 1995.
- G. W. Hunter, P. G. Neudeck, L. Y. Chen, D. Knight, C. C. Liu, and Q. H. Wu, "SiC-based Schottky diode gas sensors," 1997.
- R. K. Sharma, M. C. Bhatnagar, and G. L. Sharma, "Mechanism of highly sensitive and

- fast response Cr doped TiO₂ oxygen gas sensor,” *Sensors and Actuators B: Chemical*, vol. 45, no. 3, pp. 209-215, 1997.
- D. Dwivedi, R. Dwivedi, S. K. Srivastava., “The effect of hydrogen-induced interface traps on a titanium dioxide-based palladium gate MOS capacitor (Pd-MOSC): A conductance study,” *Microelectronics J.*, vol. 29, no. 7, pp. 445–450, 1998.
- V. Srikant, and D. R. Clarke, “On the optical band gap of zinc oxide,” *Journal of Applied Physics*, vol. 83, no. 10, pp. 5447-5451, 1998.
- W. Bolton, “Mechatronics: Electronic Control Systems in Mechanical Engineering,” Harlow, Essex, England: Addison Wesley Longman, 1999.
- I. Hayakawa, Y. Iwamoto, K. Kikuta, and S. Hirano, “Gas sensing properties of platinum dispersed-TiO₂ thin film derived from precursor,” *Sensors and Actuators B: Chemical*, vol. 62, no. 1, pp. 55-60, 2000.
- J. Xu, Q. Pan, and J. Qin, “Sensing characteristics of double layer film of ZnO,” *Sensors and Actuators B: Chemical*, vol. 66, no. 1-3, pp. 161-163, 2000.
- D. Dwivedi, R. Liu, S.K. Srivastava., "Sensing properties of palladium-gate MOS (Pd-MOS) hydrogen sensor-based on plasma grown silicon dioxide," *Sensors Actuators B Chem.*, vol. 71, no. 3, pp. 161–168, 2000.
- A. M. Gas' Kov, and M. N. Rumyantseva. “Nature of gas sensitivity in nanocrystalline metal oxides,” *Russian Journal of Applied Chemistry*, vol. 74, no. 3, pp. 440-444, 2001.
- A. D. Yoffe, “Semiconductor quantum dots and related systems: electronic, optical, luminescence and related properties of low dimensional systems,” *Advances in physics*, vol. 50, no. 1, pp. 1-208, 2001.
- T. Takeguchi, S. N. Furukawa, and M. Inoue, “Hydrogen spillover from NiO to the large surface area CeO₂-ZrO₂ solid solutions and activity of the NiO/CeO₂-ZrO₂ catalysts for partial oxidation of methane,” *Journal of Catalysis*, vol. 202, no. 1, pp. 14-24, 2001.
- Z. I. Alferov, “Nobel lecture: The double heterostructure concept and its applications in physics, electronics, and technology,” *Reviews of modern physics*, vol. 73, no. 3, pp. 767–782, 2001.
- A. Lueking, and R. T. Yang, “Hydrogen spillover from a metal oxide catalyst onto carbon nanotubes—implications for hydrogen storage,” *Journal of Catalysis*, vol.

- 206, no. 1, pp. 165-168, 2002.
- X. Du, Y. Wang, Y. Mu, L. Gui, and P. Wang, "A New Highly Selective H₂ Sensor Based on TiO₂ / PtO-Pt Dual-Layer Films," *Thin Solid Films*, vol. 8, no. 13, pp. 3953–3957, 2002.
- S. Dunn, "Hydrogen futures: Toward a sustainable energy system," *Int. J. Hydrogen Energy*, vol. 27, no. 3, pp. 235–264, 2002.
- X. H. Xu, M. Wang, Y. Hou, S. R. Zhao, H. Wang, D. Wang, and S. X. Shang, "Effect of Thermal Annealing on Structural Properties , Morphologies and Electrical Properties of TiO₂ Thin Films Grown by MOCVD," *Crystal Research and Technology: Journal of Experimental and Industrial Crystallography*, vol. 37, no. 5, pp. 431–439, 2002.
- C. Malagù, V. Guidi, M. Stefancich, M. C. Carotta, and G. Martinelli, "Model for Schottky barrier and surface states in nanostructured n-type semiconductors," *J. Appl. Phys.* vol. 91, pp. 808–14, 2002.
- M. A. Keane, and G. Tavoularis, "The role of spillover hydrogen in gas phase catalytic aromatic hydrodechlorination and hydrogenation over nickel/silica," *Reaction Kinetics and Catalysis Letters*, vol. 78, no. 1, pp. 11-18, 2003.
- J. Webb, and J. H. Holgate, "MICROSCOPY| Scanning Electron Microscopy," *Elsevier*, 2003.
- R. J. B. Balaguru and B. G. Jeyaprakash, "Mimic of a Gas sensor , Metal Oxide Gas Sensing Mechanism , Factors Influencing the Sensor Performance and Role of nanomaterials based gas sensors School of Electrical & Electronics Engineering," *NPTEL-Electrical Electron. Eng. Nanodevices*, pp. 1–30, 2004.
- K. Arshak, E. Moore, G. M. Lyons, J. Harris, and S. Clifford, "A review of gas sensors employed in electronic nose applications," *Sensor review*, 2004.
- G. Eranna, B. C. Joshi, D. P. Runthala, R. P. Gupta, "Oxide materials for development of integrated gas sensors—a comprehensive review," *Critical Reviews in Solid State and Materials Sciences*, vol. 29, no. 3-4, pp. 111-188, 2004.
- A. Rollett, F. J. Humphreys, G. S. Rohrer, and M. Hatherly, *Recrystallization and related annealing phenomena*, Elsevier, 2004.
- L. C. Tien, P. W. Sadik, D. P. Norton, L. F. Voss, S. J. Pearton, H. T. Wang, B. S. Kang, F. Ren, J. Jun, and J. Lin, "Hydrogen sensing at room temperature with

- Pt-coated ZnO thin films and nanorods,” *Appl. Phys. Lett.*, vol. 87, no. 22, p. 222106, 2005.
- B. Timmer, W. Olthuis, and A. Van Den Berg, “Ammonia sensors and their applications - a review,” *Sensors Actuators B Chem.*, vol. 107, pp. 666–677, 2005.
- D. K. Schroder, “Semiconductor material and device characterization,” *John Wiley & Sons, Inc.*, NJ, USA, 2006.
- J. X. Wang, X. W. Sun, Y. Yang, H. Huang, Y. C. Lee, O. K. Tan, and L. Vayssieres, “Hydrothermally grown oriented ZnO nanorod arrays for gas sensing applications,” *Nanotechnology*, vol. 17, no. 19, pp. 4995–4998, 2006.
- C. Lu, Z. Chen, K. Saito, “Hydrogen sensors based on Ni/SiO₂/Si MOS capacitors,” *Sensors and Actuators B: Chemical*, vol. 122, no. 2, pp. 556–559, 2007.
- X. Chen, and S. S. Mao, “Titanium dioxide nanomaterials: synthesis, properties, modifications, and applications,” *Chemical reviews*, vol. 107, no. 7, pp. 2891–2959, 2007.
- L. Yadav, N. C. Gupta, R. Dwivedi, and R. S. Singh, “Sensing behavior and mechanism of titanium dioxide-based MOS hydrogen sensor,” *Microelectronics J.*, vol. 38, no. 12, pp. 1226–1232, 2007.
- A. Z. Sadek, S. Choopun, W. Wlodarski, S. J. Ippolito, and K. Kalantar-zadeh, “Characterization of ZnO Nanobelt-Based Gas Sensor for H₂, NO₂, and Hydrocarbon Sensing,” *IEEE Sens. J.* vol. 7, pp. 919–24, 2007.
- C. Pandis, N. Brilis, E. Bourithis, D. Tsamakis, H. Ali, S. Krishnamoorthy, A. A. Iliadis, S. Member, M. Kompitsas, and A. F. Growth, “Low – Temperature Hydrogen Sensors Based on Au Nanoclusters and Schottky Contacts on ZnO Films Deposited by Pulsed Laser Deposition on Si and SiO₂ Substrates,” *IEEE Sens. J.* vol. 7, no. 3, pp. 448–454, 2007.
- Y. Y. Liu, J. L. Zeng, J. Zhang, F. Xu, and L. X. Sun, “Improved hydrogen storage in the modified metal-organic frameworks by hydrogen spillover effect,” *Int. J. Hydrogen Energy*, vol. 32, no. 16, pp. 4005–4010, 2007.
- AE J. González, and S. G. Santiago, “Structural and optoelectronic characterization of TiO₂ films prepared using the sol–gel technique,” *Semiconductor science and technology*, vol. 22, no. 7, pp. 709–716, 2007.

- K. Yao, W. W. Gong, Y. F. Hu, X. L. Liang, Q. Chen, L. M. Peng, "Individual Bi₂S₃ Nanowire-Based Room-Temperature H₂ Sensor," *J. Phys. Chem. C*, vol. 112, pp. 8721–8724, 2008.
- J. B. K. Law, and J. T. L. Thong, "Improving the NH₃ gas sensitivity of ZnO nanowire sensors by reducing the carrier concentration" *Nanotechnology*, vol. 19, no. 20, p. 205502, 2008.
- N. Tamaekong, C. Liewhiran, A. Wisitsoraat, and S. Phanichphant, "Sensing characteristics of flame-spray-made Pt/ZnO thick films as H₂ gas sensor," *Sensors*, vol. 9, no. 9, pp. 6652-6669, 2009.
- A. M. Smith, S. Nie, "Next-generation quantum dots," *Nature biotechnology*, vol. 27, no. 8, pp. 732-733, 2009.
- P. P. Sengupta, P. Kar, and B. Adhikari, "Influence of dopant in the synthesis, characteristics and ammonia sensing behavior of processable polyaniline," *Thin Solid Films*, vol. 517, no. 13, pp. 3770–3775, 2009.
- P. Pandey, J. K. Srivastava, V. N. Mishra, and R. Dwivedi, "Pd gate MOS sensor for hydrogen detection," *Solid State Sci.*, vol. 11, no. 8, pp. 1370–1374, 2009.
- Y. S. Huang, Y. Y. Chen, and T. T. Wu, "A passive wireless hydrogen surface acoustic wave sensor based on Pt-coated ZnO nanorods," *Nanotechnology* vol. 21, no. 9, p-095503, 2010
- A. Mattsson, and L. Osterlund, "Adsorption and photoinduced decomposition of acetone and acetic acid on anatase, brookite, and rutile TiO₂ nanoparticles. *The Journal of Physical Chemistry C*, vol. 114, no. 33, pp. 14121-14132, 2010.
- V. I. Klimov, "Nanocrystal Quantum Dots", second. Edited by V. I. Klimov. CRC Press. 2010.
- B. D. Adams, C. K. Ostrom, S. Chen, and A. Chen, "High-performance Pd-based hydrogen spillover catalysts for hydrogen storage," *The Journal of Physical Chemistry C*, vol. 114, no. 46, pp. 19875-19882, 2010.
- J. K. Choi, I. S. Hwang, S. J. Kim, J. S. Park, S. S. Park, U. Jeong, Y. C. Kang, and J. H. Lee, "Design of selective gas sensors using electrospun pd-doped SnO₂ hollow nanofibers," *Sensors and Actuators B: Chemical*, vol. 150, no. 1, pp. 191-199, 2010.
- M. Zhang, Z. Yuan, J. Song, and C. Zheng, "Improvement and mechanism for the fast

- response of a Pt/TiO₂ gas sensor,” *Sensors and Actuators B: Chemical*, vol. 148, no. 1, pp. 87-92, 2010.
- S. Joo, I. Muto, and N. Hara, “Hydrogen Gas Sensor Using Pt- and Pd-Added Anodic TiO₂ Nanotube Films,” *J. Electrochem. Soc.*, vol. 157, no. 6, pp. J221–J226, 2010.
- Y. Zhang, J. Xu, P. Xu, Y. Zhu, X. Chen, and W. Yu, “Decoration of ZnO nanowires with Pt nanoparticles and their improved gas sensing and photocatalytic performance,” *Nanotechnology*, vol. 21, no. 28, p. 285501, 2010.
- A. Forleo, L. Francioso, S. Capone, P. Siciliano, P. Lommens, and Z. Hens, “Synthesis and gas sensing properties of ZnO quantum dots,” *Sensors Actuators B Chem*, vol. 146, no. 1, pp. 111–115, 2010.
- H. W. Ra, R. Khan, J. T. Kim, B. R. Kang, and Y. H. Im, “The effect of grain boundaries inside the individual ZnO nanowires in gas sensing,” *Nanotechnology*, vol. 21, no. 8, p. 085502, 2010.
- V. E. Bochenkov and G. B. Sergeev, “Sensitivity, Selectivity, and Stability of Gas-Sensitive Metal-Oxide Nanostructures,” *Met. Oxide Nanostruct. Their Appl.*, vol. 3, pp. 31–52, 2010.
- S. N. Das, J. P. Kar, J-H. Choi, T. I. L. Lee, K-J. Moon, and J-M. Myoung, "Fabrication and Characterization of ZnO Single Nanowire-Based Hydrogen Sensor," *J. Phys. Chem. C*, vol. 114, pp. 1689–93, 2010.
- H. Y. Lee, H. L. Huang, and C. T. Lee, “Hydrogen sensing performances of Pt/i-ZnO/GaN metal–insulator–semiconductor diodes,” *Sensors and Actuators B: Chemical*, vol. 157, no. 2, pp. 460-465, 2011.
- N. Bârsan, “Transduction in semiconducting metal oxide based gas sensors-implications of the conduction mechanism,”. *Procedia Engineering*, vol. 25, pp. 100-103, 2011.
- J. Zhao, W. Wang, Y. Liu, J. Ma, X. Li, Y. Du, and G. Lu, “Ordered mesoporous Pd/SnO₂ synthesized by a nanocasting route for high hydrogen sensing performance,” *Sensors and Actuators B: Chemical*, vol. 160, no. 1, pp. 604-608, 2011.
- Z. Huang, N. Geyer, P. Werner, J. De Boor, and U. Gösele, “Metal-Assisted Chemical Etching of Silicon: A Review,” *Advanced materials*, vol. 23, no. 2, pp. 285–308,

- 2011.
- J. Huh, J. Park, G. T. Kim, and J. Y. Park, “Highly sensitive hydrogen detection of catalyst-free ZnO nanorod networks suspended by lithography-assisted growth,” *Nanotechnology*, vol. 22, no. 8, p. 085502, 2011.
- S. Ren G. Fan, S. Qu, and Q. Wang, “Enhanced H₂ sensitivity at room temperature of ZnO nanowires functionalized by Pd nanoparticles,” *J. Appl. Phys.* vol. 110, pp. 1–7, 2011.
- P. Pandey, J. K. Srivastava, V. N. Mishra, and R. Dwivedi, “Pd-gate MOS sensor for detection of methanol and propanol,” *J. Nat. Gas Chem.*, vol. 20, no. 2, pp. 123–127, 2011.
- Z. Wang, Y. Hu, W. Wang, X. Zhang, B. Wang, H. Tian, Y. Wang, J. Guan, and H. Gu, “Fast and highly-sensitive hydrogen sensing of Nb₂O₅ nanowires at room temperature,” *International journal of hydrogen energy*, vol. 37, no. 5, pp.4526-4532, 2012.
- S. K. Arya, S. Saha, J. E. Ramirez-Vick, V. Gupta, S. Bhansali, and S. P. Singh, “Recent advances in ZnO nanostructures and thin films for biosensor applications,” *Analytica chimica acta*, vol. 737, pp. 1-21, 2012.
- G. Vastola, Y. W. Zhang, and V. B. Shenoy, “Experiments and modeling of alloying in self-assembled quantum dots,” *Current Opinion in Solid State and Materials Science*, vol. 16, no. 2, pp. 64-70, 2012.
- M. Vishwas, K. N. Rao, and R. P. S. Chakradhar, “Influence of annealing temperature on Raman and photoluminescence spectra of electron beam evaporated TiO₂ thin films,” *Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy*, vol. 99, pp. 33–36, 2012.
- K. Seshan, Handbook of Thin Film Deposition, 3rd Edition, William Andrew, 2012.
- A. Esfandiari, S. Ghasemi, A. Irajizad, A., O. Akhavan, and M. R. Gholami, “The decoration of TiO₂/reduced graphene oxide by Pd and Pt nanoparticles for hydrogen gas sensing. *international journal of hydrogen energy*, vol. 37, no. 20, pp. 15423-15432, 2012.
- D. J. Benac and P. McAndrew, “Reducing the Risk of High Temperature Hydrogen Attack (HTHA) Failures,” *J. Fail. Anal. Prev.*, vol. 12, no. 6, pp. 624–627, 2012.
- Z. Wang, Y. Hu, W. Wang, X. Zhang, B. Wang, H. Tian, Y. Wang, J. Guan, and H. Gu,

- “Fast and highly-sensitive hydrogen sensing of Nb₂O₅ nanowires at room temperature,” *Int. J. Hydrogen Energy*, vol. 37, no. 5, pp. 4526–4532, 2012.
- M. Vishwas, K. N. Rao, and R. P. S. Chakradhar, “Influence of annealing temperature on Raman and photoluminescence spectra of electron beam evaporated TiO₂ thin films,” *Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy*, vol. 99, pp. 33–36, 2012.
- C. Zhang, A. Boudiba, P. De Marco, R. Snyders, M. G. Olivier, and M. Debliquy, “Room temperature responses of visible-light illuminated WO₃ sensors to NO₂ in sub-ppm range,” *Sensors and Actuators B: Chemical*, vol. 181, pp. 395–401, 2013.
- D. Jariwala, V. K. Sangwan, L. J. Lauhon, T. J. Marks, and M. C. Hersam, “Carbon nanomaterials for electronics, optoelectronics, photovoltaics, and sensing,” *Chemical Society Reviews*, vol. 42, no. 7, pp. 2824–2860, 2013.
- A. Boudiba, C. Zhang, P. Umek, C. Bittencourt, R. Snyders, M. G. Olivier, and M. Debliquy, “Sensitive and rapid hydrogen sensors based on Pd–WO₃ thick films with different morphologies,” *International journal of hydrogen energy*, vol. 38, no. 5, pp. 2565–2577, 2013.
- R. J. Martín-Palma, and A. Lakhtakia “Vapor-Deposition Techniques,” *Engineered Biomimicry*, pp. 383–398, 2013.
- P. Bhattacharyya, S. Roy, and C. K. Sarkar, “Integration of ZnO nanoflakes with MEMS platform and its application as gas sensor,” *Proc. Int. Conf. Sens. Technol. ICST*, pp. 7–10, 2013.
- X. Liu, H. Dong, S. Xia, “Micromachined catalytic combustion type gas sensor for hydrogen detection,” *Micro Nano Lett.*, vol. 8, no. 10, pp. 668–671, 2013.
- Z. Wu, X. Chen, S. Zhu, Z. Zhou, Y. Yao, W. Quan, B. Liu, “Enhanced sensitivity of ammonia sensor using graphene/polyaniline nanocomposite,” *Sensors Actuators B Chem.*, vol. 178, pp. 485–493, 2013.
- C. Ling, Q. Xue, Z. Han, Z. Zhang, Y. Du, Y. Liu, and Z. Yan, “High hydrogen response of Pd/TiO₂/SiO₂/Si multilayers at room temperature,” *Sensors Actuators B Chem.*, vol. 205, pp. 255–260, 2014.
- B. Mondal, B. Basumatari, J. Das, C. Roychaudhury, H. Saha, and N. Mukherjee, “ZnO–SnO₂ based composite type gas sensor for selective hydrogen

- sensing,” *Sensors and Actuators B: Chemical*, vol. 194, pp.389-396, 2014.
- M. Bagheri, N. F. Hamedani, A. R. Mahjoub, A. A. Khodadadi, and Y. Mortazavi, “Highly sensitive and selective ethanol sensor based on Sm₂O₃-loaded flower-like ZnO nanostructure,” *Sensors and Actuators B: Chemical*, vol. 191, pp. 283-290, 2014.
- W. Zhou, W. Li, J. Q. Wang, Y. Qu, Y. Yang, Y. Xie, K. Zhang, L. Wang, H. Fu, and D. Zhao, “Ordered mesoporous black TiO₂ as highly efficient hydrogen evolution photocatalyst,” *Journal of the American Chemical Society*, vol. 136, no. 26, pp. 9280-9283, 2014.
- R. K. Pandey, A. K. Singh, and R. Prakash, “Directed self-assembly of poly(3,3'-dialkylquarterthiophene) polymer thin film: Effect of annealing temperature,” *J. Phys. Chem. C*, vol. 118, no. 40, pp. 22943–22951, 2014.
- B. Liu, D. Cai, Y. Liu, D. Wang, L. Wang, Y. Wang, H. Li, Q. Li, T. Wang, “Improved room-temperature hydrogen sensing performance of directly formed Pd/WO₃ nanocomposite,” *Sensors Actuators B Chem.*, vol. 193, pp. 28–34, 2014.
- C. Xiang, Z. She, Y. Zou, J. Cheng, H. Chu, S. Qiu, H. Zhang, L. Sun, F. Xu, “A room-temperature hydrogen sensor based on Pd nanoparticles doped TiO₂ nanotubes,” *Ceram. Int.*, vol. 40, no. PB, pp. 16343–16348, 2014.
- G. Neri, "First fifty years of chemoresistive gas sensors," *Chemosensors*, vol. 3, no. 1, pp. 1-20, 2015.
- L. Xiao, S. Shu, and S. Liu, “A facile synthesis of Pd-doped SnO₂ hollow microcubes with enhanced sensing performance,” *Sensors and Actuators B: Chemical*, vol. 221, pp. 120-126, 2015.
- L. K. Bagal, J. Y. Patil, M. V. Vaishampayan, I. S. Mulla, and S. S. Suryavanshi, “Effect of Pd and Ce on the enhancement of ethanol vapor response of SnO₂ thick films,” *Sensors and Actuators B: Chemical*, vol. 207, pp. 383-390, 2015.
- J. Kanungo, S. Basu, and C. K. Sarkar, “Fabrication and Characterization of ZnO/p-Si and TiO₂/p-Si Heterojunctions for Hydrogen Detection - Influence of Pd Functionalization,” *IEEE Sens. J.*, vol. 15, no. 12, pp. 6954–6961, 2015.
- L. Giancaterini, C. Cantalini, M. Cittadini, M. Sturaro, M. Guglielmi, A. Martucci, A. Resmini, and U. Anselmi-Tamburini, "Au and Pt Nanoparticles Effects on the Optical and Electrical Gas Sensing Properties of Sol – Gel-Based ZnO Thin-Film

- Sensors *IEEE Sens. J.*, vol. 15, no. 2, pp.1068–1076, 2015.
- Z. Alaie, S. M. Nejad, and M. H. Yousefi, “Recent advances in ultraviolet photodetectors,” *Materials Science in Semiconductor Processing*, vol. 29, pp. 16–55, 2015.
- G. Rawat, D. Somvanshi, H. Kumar, Y. Kumar, C. Kumar, S. Jit, “Ultraviolet detection properties of p-Si/n-TiO₂ heterojunction photodiodes grown by electron-beam evaporation and sol–gel methods: A comparative study,” *IEEE Transactions on Nanotechnology*, vol. 15, no. 2, pp. 193-200, 2015.
- M. Zhang, Y. Zhen, F. Sun, and C. Xu, “Hydrothermally synthesized SnO₂-graphene composites for H₂ sensing at low operating temperature,” *Mater. Sci. Eng. B*, vol. 209, pp. 37–44, 2016.
- M. A. Hajja, A. I. Ayesh, S. Ahmed, and M. S. Katsiotis, “Selective hydrogen gas sensor using CuFe₂O₄ nanoparticle based thin film,” *Appl. Surf. Sci.*, vol. 369, pp. 443–447, 2016.
- C. Zhang, J. Wang, and X. Geng, “Tungsten oxide coatings deposited by plasma spray using powder and solution precursor for detection of nitrogen dioxide gas,” *Journal of Alloys and Compounds*, vol. 668, pp.128-136, 2016.
- F. E. Annanouch, Z. Haddi, M. Ling, F. Maggio, Di, S. Vallejos, T. Vilic, Y. Zhu, T. Shujah, P. Umek, C. Bittencourt, and C. Blackman, “Aerosol-assisted CVD-grown PdO nanoparticle-decorated tungsten oxide nanoneedles extremely sensitive and selective to hydrogen,” *ACS applied materials & interfaces*, vol. 8, no. 16, pp. 10413-10421, 2016.
- B. Shougaijam, R. Swain, C. Ngangbam, and T. R. Lenka, “Enhanced Photodetection by Glancing Angle Deposited Vertically Aligned TiO₂ Nanowires,” *IEEE Transactions on Nanotechnology*, vol. 15, no. 3, pp. 389–394, 2016.
- A. C. Lokhande, R. B. V. Chalapathy, M. He, E. Jo, M. Gang, S.A.Pawar, C.D.Lokhande, and J. H. Kim, “Development of Cu₂SnS₃ (CTS) thin film solar cells by physical techniques: A status review,” *Solar Energy Materials and Solar Cells*, vol. 153, pp.84-107, 2016.
- J. Moon, H. P. Hedman, M. Kemell, A. Tuominen, and R. Punkkinen, “Hydrogen sensor of Pd-decorated tubular TiO₂ layer prepared by anodization with patterned electrodes on SiO₂/Si substrate,” *Sensors Actuators B Chem.*, vol. 222, pp. 190–

- 197, 2016.
- S. Erdem, O. Alev, and Z. Z. Öztürk, “The effect of Pd on the H₂ and VOC sensing properties of TiO₂ nanorods,” *Sensors Actuators B Chem.*, vol. 229, pp. 692–700, 2016.
- W. P. Chen, Y. Xiong, Y. S. Li, P. Cui, S. S. Guo, W. Chen, Z. L. Tang, Z. Yan, and Z. Zhang, “Extraordinary room-temperature hydrogen sensing capabilities of porous bulk Pt–TiO₂ nanocomposite ceramics.” *international journal of hydrogen energy*, vol. 41, no. 4, pp. 3307-3312, 2016.
- S. Ranwa, S. S. Barala, M. Fanetti, and M. Kumar, “Effect of gamma irradiation on Schottky-contacted vertically aligned ZnO nanorod-based hydrogen sensor,” *Nanotechnology*, vol. 27, no. 34, p. 345502, 2016.
- L. Rajan, C. Periasamy, and V. Sahula, “Comprehensive Study on Electrical and Hydrogen Gas Sensing Characteristics of Pt/ZnO Thin Film Based Schottky Diodes Grown on n-Si Substrates by RF sputtering,” *IEEE Trans. Nanotechnol.* vol. 15, no. 2, pp. 201–208, 2016.
- K. Hassan, A. I. Uddin, and G. S. Chung, “Fast-response hydrogen sensors based on discrete Pt/Pd bimetallic ultra-thin films,” *Sensors and Actuators B: Chemical*, vol. 234, pp. 435-445, 2016.
- M. A. Haija, A. I. Ayes, S. Ahmed, and M. S. Katsiotis, “Selective hydrogen gas sensor using CuFe₂O₄ nanoparticle based thin film,” *Appl. Surf. Sci.*, vol. 369, pp. 443–447, 2016.
- G. Rawat, D. Somvanshi, Y. Kumar, H. Kumar, C. Kumar, and S. Jit, “Electrical and Ultraviolet-A Detection Properties of E- Beam Evaporated n-TiO₂ Capped p-Si Nanowires Heterojunction Photodiodes,” *IEEE Trans. Nanotechnol.*, vol. 16, no. c, pp. 49--57, 2016.
- M. Kumar, V. S. Bhati, S. Ranwa, J. Singh, and M. kumar, “Pd/ZnO nanorods based sensor for highly selective detection of extremely low concentration hydrogen,” *Sci. Rep.*, vol. 7, pp.1–9, 2017.
- J. H. Choi, M. G. Jo, S. W. Han, H. Kim, S. H. Kim, S. Jang, J. S. Kim, and H. Y. Cha, “Hydrogen gas sensor of Pd-functionalised AlGa_N/Ga_N heterostructure with high sensitivity and low-power consumption,” *Electron. Lett.*, 53, (17), pp. 1200–1202, 2017.

- Y. Luo, C. Zhang, B. Zheng, X. Geng, M. Debliquy “Hydrogen sensors based on noble metal doped metal-oxide semiconductor: A review,” *Int. J. Hydrogen Energy*, vol. 2, pp. 20386--2039712, 2017.
- L. Rajan, P. Chinnamuthan, V. Krishnasamy, and V. Sahula, “An Investigation on Electrical and Hydrogen Sensing Characteristics of RF Sputtered ZnO Thin-Film with Palladium Schottky Contacts,” *IEEE Sens. J.*, vol. 17, no. 1, pp. 14–21, 2017.
- T. Q. Trung, and N. E. Lee, “Recent progress on stretchable electronic devices with intrinsically stretchable components,” *Advanced Materials*, vol. 29, no. 3, p.1603167, 2017.
- C. Zhang, X. Geng, H. Liao, C. J. Li, and M. Debliquy, “Room-temperature nitrogen-dioxide sensors based on ZnO_{1-x} coatings deposited by solution precursor plasma spray,” *Sensors and Actuators B: Chemical*, vol. 242, pp. 102-111, 2017.
- F. Fan, J. Zhang, J. Li, N. Zhang, R. Hong, X. Deng, P. Tang, and D. Li, “Hydrogen sensing properties of Pt-Au bimetallic nanoparticles loaded on ZnO nanorods,” *Sensors and Actuators B: Chemical*, vol. 241, pp. 895-903, 2017.
- K. K. Paul, and P. K. Giri, “Shape Tailored TiO₂ Nanostructures and Its’ Hybrids for Advanced Energy and Environmental Applications: A Review,” *Journal for Nanoscience and Nanotechnology*, pp. 1-59, 2017.
- A. G. Boudjahem, and M. M. Bettahar, “Effect of oxidative pre-treatment on hydrogen spillover for a Ni/SiO₂ catalyst,” *Journal of Molecular Catalysis A: Chemical*, vol. 426, pp. 190-197, 2017.
- A. Dey, B. Kantha, S.K. Sarkar., “Sol-gel grown Pd modified WO₃ thin film based methanol sensor and the effect of annealing temperatures,” *Microsyst. Technol.*, vol. 23, no. 9, pp. 4195–4201, 2017.
- A. Jilani *et al.*, “Advance deposition techniques for thin film and coating,” *Modern Technologies for Creating the Thin-film Systems and Coatings*, vol. 2, pp. 137-149, 2017.
- K. Hassan, and G. S. Chung, “Catalytically activated quantum-size Pt/Pd bimetallic core-shell nanoparticles decorated on ZnO nanorod clusters for accelerated hydrogen gas detection,” *Sensors Actuators B Chem.*, vol. 239, pp. 824–833, 2017.

- D. Abubakar, N. M. Ahmed, S. Mahmud, M. Kumar, R. Kumar, S. Rajamani, and S. Ranwa, "Efficient room temperature hydrogen sensor based on UV-activated ZnO nano-network," *Nanotechnology*, vol. 28, no. 36, p. 365502, 2017.
- Y. Zhao, W. Zhang, B. Yang, J. Liu, X. Chen, X. Wang, and C. Yang, "Gas-sensing enhancement methods for hydrothermal synthesized SnO₂ -based sensors," *Nanotechnology*, vol. 28, no. 45, p. 452002, 2017.
- A. Lv, Y. Pan, and L. Chi, "Gas sensors based on polymer field-effect transistors," *Sensors*, vol. 17, no. 1, p. 213, 2017.
- C. Kumar, G. Rawat, H. Kumar, Y. Kumar, R. Prakash, and S. Jit, "Electrical and ammonia gas sensing properties of poly(3, 3''-dialkylquaterthiophene) based organic thin film transistors fabricated by floating-film transfer method," *Org. Electron.*, vol. 48, pp. 53–60, 2017.
- Y. Kumar, H. Kumar, G. Rawat, C. Kumar, A. Sharma, B. N. Pal, and S. Jit, "Colloidal ZnO Quantum Dots Based Spectrum Selective Ultraviolet Photodetectors," *IEEE Photonics Technol. Lett.*, vol. 29, pp. 361–364, 2017.
- Y. Kumar, H. Kumar, B. Mukherjee, G. Rawat, C. Kumar, B. N. Pal, and S. Jit, "Visible-Blind Au/ZnO Quantum Dots-Based Highly Sensitive and Spectrum Selective Schottky Photodiode," *IEEE Trans. Electron Devices*, vol. 64, pp. 2874–2880, 2017.
- H. Kumar, Y. Kumar, G. Rawat, C. Kumar, B. Mukherjee, B. N. Pal, and S. Jit S, "Heating Effects of Colloidal ZnO Quantum Dots (QDs) on ZnO QDs/CdSe QDs/MoOx Photodetectors," *IEEE Trans. Nanotechnol.*, vol. 16, pp. 1073–80, 2017.
- A. Lee, J. Y. Choi, and H. K. Yu., "Mimicking of five human senses using nanostructured ZnO single material," *Nanotechnology*, vol. 29, no. 47, pp. 475501, 2018.
- G. B. Pour, L.F. Aval, "Monitoring of hydrogen concentration using capacitive nanosensor in a 1% H₂-N₂ mixture," *Micro Nano Lett.*, vol. 13, no. 2, pp. 149–153, 2018.
- C. Kumar, G. Rawat, H. Kumar, Y. Kumar, R. Prakash, and S. Jit, "Flexible poly (3, 3''-dialkylquaterthiophene) based interdigitated metal-semiconductor-metal ammonia gas sensor. *Sensors and Actuators B: Chemical*, vol. 255, pp. 203-209,

- 2018.
- C. Kumar, G. Rawat, H. Kumar, Y. Kumar, A. Kumar, R. Prakash, and S. Jit, "Electrical and ammonia gas sensing properties of PQT-12/CdSe quantum dots composite-based organic thin film transistors," *IEEE Sensors Journal*, vol. 18, no. 15, pp. 6085-6091, 2018.
- P. N. Sudha, K. Sangeetha, K. Vijayalakshmi, and A. Barhoum, "Nanomaterials history, classification, unique properties, production and market," *In Emerging Applications of Nanoparticles and Architecture Nanostructures*, pp. 341-384, 2018.
- B. S. Hameed, C. S. Bhatt, B. Nagaraj, and A. K. Suresh, "Chromatography as an Efficient Technique for the Separation of Diversified Nanoparticles," *Nanomaterials in Chromatography, Elsevier*, pp. 503-518, 2018.
- K. Lakshmanan, A. M. Vijayakumari, and P. K. Basu, "Reliable and Flow Independent Hydrogen Sensor Based on Microwave-Assisted ZnO Nanospheres: Improved Sensing Performance under UV Light at Room Temperature," *IEEE Sens. J.*, vol. 18, no. 1810–1819, 2018.
- C. Kumar, G. Rawat, H. Kumar, Y. Kumar, S. Ratan, R. Parkash, and S. Jit, "Poly (3, 3"-dialkylquaterthiophene) Based Flexible Nitrogen Dioxide Gas Sensor," *IEEE Sensors Lett.*, Vol. 2, no. 1, p. 4500104, 2018.
- M. Lu, W. Yin, A. Peyton, Z. Qu, X. Meng, Y. Xie, P. Zhao, J. Luo, Q. Zhao, Y. Tao, and T. Zhou, "A model for the triboelectric nanogenerator with inductive load and its energy boost potential," *Nano Energy*, 63, p. 103883, 2019.
- D. K. Jarwal, A. Kumar, A. K. Mishra, S. Ratan, C. Kumar, D. Upadhyay, B. Mukherjee, and S. Jit, "Efficiency Improvement of TiO₂ Nanorods Electron Transport Layer Based Perovskite Solar Cells by Solvothermal Etching," *IEEE J. Photovoltaics*, vol. 9, pp. 1699–1707, 2019.
- F. R. Juang, "Ag additive and nanorod structure enhanced gas sensing properties of metal oxide-based CO₂ sensor. *IEEE Sensors Journal*, vol. 19, no. 12, pp. 4381-4385, 2019.
- V. K. Tomer, R. Malik, V. Chaudhary, A. Baruah, and L. Kienle, "Noble metals–metal oxide mesoporous nanohybrids in humidity and gas sensing applications," *In Noble Metal-Metal Oxide Hybrid Nanoparticles*, pp. 283-302, 2019.

- A. Mishra, N. Bhatt, and A. K. Bajpai, "Nanostructured superhydrophobic coatings for solar panel applications," In *Nanomaterials-Based Coatings, Elsevier*, (pp. 397-424) 2019.
- M. Nasrollahzadeh, M. Atarod, M. Sajjadi, S. M. Sajadi, and Z. Issaabadi, "Plant-Mediated Green Synthesis of Nanostructures: Mechanisms, Characterization, and Applications," In *Interface Science and Technology*, vol. 28, pp. 199-322, Elsevier, 2019.

[IR1] <https://www.electronicshub.org/different-types-sensors/>

[IR2] <https://www.figaro.co.jp/en/company/history.html>

[IR3] <https://www.google.com/search?q=rutile+anatase+and+brookite+unit+cell>

[IR4] https://en.wikipedia.org/wiki/Zinc_oxide

[IR5] <http://metamodern.com/2009/12/29/theres-plenty-of-room-at-the-bottom%E2%80%9D-feynman-1959/>

AUTHOR'S RELEVANT PUBLICATIONS

Journals:

1. **Smrity Ratan**, Chandan Kumar, Amit Kumar, Deepak Kumar Jarwal, Ashwini Kumar Mishra, and Satyabrata Jit, "Fabrication and Characterization of Titanium Dioxide Based Pd/TiO₂/Si MOS Sensor for Hydrogen Gas," *IEEE Sensors Journal*, vol. **18**, no. **10**, pp. **3952-3959**, 2018.
2. **Smrity Ratan**, Chandan Kumar, Amit Kumar, Deepak Kumar Jarwal, Ashwini Kumar Mishra, Rishibrind Kumar Upadhyay, and Satyabrata Jit, "Fabrication and characterization of a ZnO quantum dots-based metal-semiconductor-metal sensor for hydrogen gas," *Nanotechnology*, vol. **30**, no. **39**, pp. **7**, 2019.
3. **Smrity Ratan**, Chandan Kumar, Amit Kumar, Deepak Kumar Jarwal, Ashwini Kumar Mishra, Rishibrind Kumar Upadhyay, Abhinav Pratap Singh, and Satyabrata Jit "Room Temperature High Hydrogen Gas Response in Pd/TiO₂/Si/Al Capacitive Sensor," *IET Micro & Nano Letter*, vol. **15**, no. **9**, pp. **632-635**, 2020.

Conferences:

1. **Smrity Ratan**, Chandan Kumar, Amit Kumar, Deepak Kumar Jarwal, Ashwini Kumar Mishra, Rishibrind Kumar Upadhyay, and Satyabrata Jit. "Performance of ZnO Quantum Dotes Based Photodetectors: Effect of Metal Electrodes". *IEEE conference Indicon, 2018 IEEE*