References

Abbasi,M.A., Ibupoto,Z.H., Hussain,M., Pozina,G., Lu,J., Hultman,L., Nur,O., and Willander,M., (2014), "Decoration of ZnO nanorods with coral reefs like NiO nanostructures by the hydrothermal growth method and their luminescence study", *Materials*, Vol. 7, pp. 430–440, 2014.

Abideen, Z.U., Katoch,A., Kim,J.-H., Kwon,Y.J., Kim,H.W., and Kim,S.S., (2015), "Excellent Gas Detection of ZnO Nanofibers by Loading with Reduced Graphene Oxide Nanosheets", *Sensors and Actuators B*, Vol. 221, pp. 1499-1507, 2015.

Abideen,Z.U., Kim,H.W., and Kim,S.S., (2015), "An Ultra-Sensitive Hydrogen Gas Sensor Using Reduced Graphene Oxide-Loaded ZnO Nanofibers", *Chemical Communications*, Vol. 51, pp. 15418−15421, 2015.

Afzal,A., Cioffi,N., Sabbatini,L., and Torsi,L., (2012), "NO_x sensors based on semiconducting metal oxide nanostructures: progress and perspectives", *Sensors and Actuators B*, Vol. 171, pp. 25–42, 2012.

Anand,K., Singh,O., Singh,M.P., Kaur,J., and Singh,R.C., (2014), "Hydrogen Sensor Based on Graphene/ZnO Nanocomposite", *Sensors and Actuators B*, Vol. 195, pp. 409-415, 2014.

Anasthasiya,A.N.A., Kishore,K.R., Rai,P.K., and Jeyaprakash,B.G., (2018), "Highly sensitive graphene oxide functionalized ZnO nanowires for ammonia vapour detection at ambient temperature", *Sensors and Actuators B*, Vol. 255, pp. 1064–1071, 2018.

Araga,R., Kali,S., and Sharma,C.S., (2017), "Low temperature catalyst-assisted pyrolysis of polymer precursors to carbon, *Bulletin of Materials Science*", Vol. 40, pp. 1519–1527, 2017.

Babaei,F.H., and Rahbrarpour,S., (2011), "Separate assessment of chemoresistivity and Schottky-Type gas sensitivity in M-metal oxide-M structures", *Sensors and Actuators B*, Vol. 160, pp. 174-180, 2011.

Bai,B.C., and Bae,T.S, (2016), "Pore structure control of activated carbon fiber for CO gas sensor electrode", *Carbon Letters*, Vol. 18, pp. 76-79, 2016.

Bai,J., and Zhou,B., (2014), "Titanium Dioxide Nanomaterials for Sensor Applications", *Chemical Reviews*, Vol. 114, pp. 10131−10176, 2014.

Bai,S., Guo,T., Zhao,Y., Sun,J., Li,D., Chen,A., and Liu,C.C., (2014), "Sensing Performance and Mechanism of Fe-Doped ZnO Microflowers", *Sensors and Actuators B*, Vol. 195, pp. 657-666, 2014.

Barreca,D., Bekermann,D., Comini,E., Devi,A., Fischer,R.A., Gasparotto,A., Maccato,C., Sberveglieri,G., and Tondello,E., (2010), "1D ZnO nano-assemblies by Plasma-CVD as chemical sensors for flammable and toxic gases", *Sensors and Actuators B*, Vol. 149, pp. 1–7, 2010.

Barthwal,S., Singh,B., Barthwal,S., and Singh,N.B., (2017), "ZnO-CNT Nanocomposite Based Gas Sensors - an Overview", *Sensor Letters*, Vol. 15, pp. 955-969, 2017.

Bergveld,P., (1970),"Development of an ion-sensitive solid-state device for neurophysiological measurements", *IEEE Transactions on Biomedical Engineering*, Vol. 17, 70-71, 1970.

Bhati,V.S., Hojamberdiev,M., and KumarM., (2019), "Enhanced sensing performance of ZnO nanostructures-based gas sensors: A review", *Energy Reports*, 2019.

Bhati,V.S., Ranwa,S., Fanetti,M., Valant,M., and Kumar,M., (2018), "Efficient Hydrogen Sensor Based on Ni-Doped ZnO Nanostructures by RF Sputtering", *Sensors and Actuators B,* Vol. 255, pp. 588-597, 2018.

Bhati,V.S., Ranwa,S., Rajamani,S., Kumari,K., Raliya,R., Biswas,P., and Kumar,M., (2018), "Improved Sensitivity with Low Limit of Detection of a Hydrogen Gas Sensor Based on rGO-Loaded Ni-Doped ZnO Nanostructures", *ACS Applied Materials & Interfaces*, Vol. 10, pp. 11116- 11124, 2018.

Bhattacharyya,P., Basu,P.K., Saha,H., and Basu,S., (2007), "Fast Response Methane Sensor Using Nanocrystalline Zinc Oxide Thin Films Derived by Sol–Gel Method", *Sensors and Actuators B*, Vol. 124, pp. 62-67, 2007.

Bindra,P., and Hazra,A., (2018), "Capacitive gas and vapor sensors using nanomaterials", *Journal of Materials Science: Materials in Electronics*, Vol. 29, pp. 6129–6148, 2018.

Bochenkov,V.E., and Sergeev,G.B., (2010), "Sensitivity, selectivity, and stability of gas-sensitive metal oxide nanostructures and their applications", Metal Oxide Nanostructures and their applications, *American Scientific Publishers*, vol.3 Vol. 3, pp. 31-52, 2010.

Bogue,R., (2015), "Detecting gases with light: a review of optical gas sensor technologies", *Sensor Review*, Vol. 35/2, pp. 133-140, 2015.

Bouaoud,A., Rmili,A., Ouachtari,F., Louardi,A., Chtouki,T., Elidrissi,B., and Erguig,H., (2013), "Transparent conducting properties of Ni doped zinc oxide thin films prepared by a facile spray pyrolysis technique using perfume atomizer", *Materials Chemistry and Physics*, Vol. 137, pp. 843–847, 2013.
Byun,S.J., Lim,H., Shin,G.Y., Han,T.H., Oh,S.H., Ahn,J.H., and Lee,T.W., (2011), "Graphenes converted from polymers", *The Journal of Physical Chemistry Letters*, Vol. 2 pp. 493–497, 2011.
Chang,C.-M., Hon,M.-H., and Leu,I.-C., (2013), "Outstanding H_2 Sensing Performance of Pd Nanoparticle-Decorated ZnO Nanorod Arrays and the Temperature-Dependent Sensing Mechanisms", *ACS Applied Materials & Interfaces*, Vol. 5, pp. 135-143, 2013.
Chatterjee,S.G, Chatterjee,S., Ray,A.K., and Chakraborty,A.K., (2015), "Graphene–metal oxide nanohybrids for toxic gas sensor: A review", *Sensors and Actuators B*, Vol. 221, pp. 1170–1181, 2015.
Chen,X., Shen,Y., Zhou,P., Zhao,S., Zhong,X., Li,T., Han, C., Wei,D., and Meng,D., (2019), "NO_2 Sensing Properties of One-Pot-Synthesized ZnO Nanowires with Pd Functionalization", *Sensors and Actuators B*, Vol. 280, pp. 151-161, 2019.
Chen,X., Shen,Y., Zhou,P., Zhong,X., Li,G., Han,C., Wei,D., and Li,S., (2019), "Bimetallic Au/Pd Nanoparticles Decorated ZnO Nanowires for NO_2 Detection", *Sensors and Actuators B*, Vol. 289, pp. 160-168, 2019.
Chen,Y., Li,X., Li,X., Wang,J., and Tang,Z., (2016), "UV Activated Hollow ZnO Microspheres for Selective Ethanol Sensors at Low Temperatures", *Sensors and Actuators B*, Vol. 232, pp. 158-164, 2016.
Cheng, Z., Zhou,S., Chen,T., Dong,Y., Zhang,W., and Chu,X., (2012), "Acetic Acid Gas Sensors Based on Ni^{2+} Doped ZnO Nanorods Prepared by Using the Solvothermal Method", *Journal of Semiconductors*, Vol. 33, pp. 112003, 2012.
Cho,K.T., Lee,S.B., and Lee,J.W., (2014), "Facile synthesis of highly electrocapacitive nitrogen doped graphitic porous carbons", *The Journal of Physical Chemistry C*, Vol. 118, pp. 9357–9367, 2014.
Chu,X., Zhu,X., Dong,Y., Zhang,W., and Bai,L., (2015), "Formaldehyde sensing properties of SnO Graphene composites prepared via hydrothermal method", *Journal of Material Science and Technology Research,* Vol. 31, pp. 913–917, 2015.
Cui,J., Shi,L., Xie,T., Wang,D., Lin,Y., (2016), "UV-Light Illumination Room Temperature HCHO Gas-Sensing Mechanism of ZnO with Different Nanostructures", *Sensors and Actuators B*, Vol. 227, pp. 220-226, 2016.
Cullity,B.D., (1978), "Elements of X-ray diffraction", Addition *Wesley Publishing Company*, Inc., 2nd Edition, 1978.
Dey,A., (2018), "Semiconductor metal oxide gas sensors: A review", *Materials Science and Engineering B*, Vol. 229, pp. 206–217, 2018.
Donarelli,M., Prezioso,S., Perrozzi,F., Bisti,F., Nardone,M., Giancaterini,L., Cantalini,C., and Ottaviano,L., (2015), "Response to NO_2 and other gases of resistive chemically exfoliated MoS_2-based gas sensors", *Sensors and Actuators B,* Vol. 207, pp. 602–13, 2015.
Drmosh,Q.A., Hendi,A.H., Hossain,M.K., Yamani,Z.H., Moqbel,R.A., Hezam,A., and Gondal,M.A., (2019), "UV-Activated Gold Decorated rGO/ZnO Heterostructured Nanocomposite Sensor for Efficient Room Temperature H_2 Detection", *Sensors and Actuators B*, Vol. 290, pp. 666-675, 2019.
Drobek,M., Kim,J.H., Bechelany,M., Vallicari,C., Julbe,A., and Kim,S.S., (2016), "MOF-based membrane encapsulated ZnO nanowires for enhanced gas sensor selectivity", *ACS Applied Materials & Interfaces*, Vol. 8, pp. 8323–8328, 2016.
Drobek,M., Kim,J.H., Bechelany,M., Vallicari,C., Leroy,E., Julbe,A., and Kim,S.S., (2018), "Design and fabrication of highly selective H_2 sensors based on SIM-1 nano membrane coated ZnO nanowires", *Sensors and Actuators B,* Vol. 264, pp. 410–418, 2018.
Esfandiar,A., Irajizad,A., Akhavan,O., Ghasemi,S., and Gholami,M.R., (2014), "Pd−WO_3/Reduced Graphene Oxide Hierarchical Nanostructures as Efficient Hydrogen Gas Sensors", *International Journal of Hydrogen Energy*, Vol. 39, pp. 8169−8179, 2014.
Espid,E., and Taghipour,F., (2017), "Development of Highly Sensitive ZnO/In_2O_3 Composite Gas Sensor Activated by UV-LED", *Sensors and Actuators B,* Vol. 241, pp. 828-839, 2017.
Fan,F., Zhang,J., Li,J., Zhang,N., Hong,R., Deng,X., Tang,P., and Li,D., (2017), "Hydrogen Sensing Properties of Pt-Au Bimetallic Nanoparticles Loaded on ZnO Nanorods", *Sensors and Actuators B*, Vol. 241, pp. 895-903, 2017.
Garciduenas,L.C., Azzarelli,B., Acuna,H., Garcia,R., Gambling,T.M., Osnaya,N., Monroy,S., Tizapantzi,M.D.R., Carson,J.L., Calderon,A.V., and Rewcastle,B., (2002), " Air Pollution and Brain Damage", *TOXICOLOGIC PATHOLOGY,* Vol 30, pp. 373–389, 2002.
Gardner,J.W., and Bartlett,P.N., (1994), "A brief history of electronic noses", *Sensors and Actuators B*, Vol. 18-19, pp. 211-220, 1994.
Geim,A.K., and Novoselov,K.S., (2007), "The rise of graphene", *Nature Materials*, Vol. 6 (3) pp. 183-191, 2007.

Ghosh,R., Midya,A., Santra,S., Ray,S.K., and Guha,P.K., (2013), "Chemically Reduced Graphene Oxide for Ammonia Detection at Room Temperature", *ACS Applied Materials & Interfaces*, Vol. 5, pp. 7599-7603, 2013.
Gong,H., Hu,J.Q., Wang,J.H., Ong,C.H., and Zhu,F.R., (2006), "Nano-Crystalline Cu-Doped ZnO Thin Film Gas Sensor for Co", *Sensors and Actuators B,* Vol. 115, pp. 247-251, 2006.
Gong,J.; Chen,Q.; Lian,M.; Liu,N.; Stevenson,R.G.; and Adamic,F., (2006), "Micromachined Nanocrystalline Silver Doped SnO_2 H_2S Sensor", *Sensors and Actuators B*, Vol. 114, pp. 32-39, 2006.
Gouma,P.I., and Mills,M.J., (2001), "Anatase-to-Rutile Transformation in Titania Powders", *The Journal of the American Ceramic Society*, Vol. 83, pp. 619-622, 2001.
Guo,D., Xie,G., and Luo.J., (2013), "Mechanical properties of nanoparticles: basics and applications", *Journal of Physics D: Applied Physics*, Vol. 47(1), pp. 013001, 2013.
Guo,J., Zhang,J., Zhu,M., Ju,D., Xu,H., and Cao,B., (2014), "High-Performance Gas Sensor Based on ZnO Nanowires Functionalized by Au Nanoparticles", *Sensors and Actuators B*, Vol. 199, pp. 339-345, 2014.
Gupta,S., Chatterjee,S., Ray,A.K., and Chakraborty,A.K., (2015), "Graphene–Metal Oxide Nanohybrids for Toxic Gas Sensor: A Review", *Sensors and Actuators B*, Vol. 221, pp. 1170-1181, 2015.
H. Ren, C. Gu, S.W. Joo, J. Zhao, Y. Sun, and J. Huang, (2018), "Effective hydrogen gas sensor based on NiO@rGO nanocomposite", *Sensors and Actuators B,* Vol. 266, pp. 506–513, 2018.
Hammond,C., (2001), "The Basics of Crystallography and Diffraction", Oxford University Press, 2nd Edition, 2001.
Han,C., Li,X., Shao,C., Li,X., Ma,J., Zhang,X., and Liu,Y., (2019), "Composition-Controllable *p*-CuO/*n*-ZnO Hollow Nanofibers for High-Performance H_2S Detection", *Sensors and Actuators B*, Vol. 285, pp. 495-503, 2019.
Hassan,K., and Chung,G.S., (2017), "Catalytically activated quantum-size Pt/Pd bimetallic core–shell nanoparticles decorated on ZnO nanorod clusters for accelerated hydrogen gas detection, *Sensors and Actuators B,* Vol. 239, pp. 824–833, 2017.
Hazra,S.K., and Basu,S., (2006), "Hydrogen Sensitivity of ZnO p−n Homojunctions", *Sensors and Actuators B*, Vol. 117, pp. 177−182, 2006.
He,Q., Zeng,Z., Yin,Z., Li,H., Wu,S., Huang,X., and Zhang,H., (2012), "Fabrication of flexible MoS_2 thin-film transistor arrays for practical gas-sensing applications", *Small,* Vol. 8 pp. 2994–99, 2012.
Hodgkinson,J., and Tatam,R.P., (2013), "Optical gas sensing: a review", *Measurement Science and Technology,* Vol. 24, pp. 012004, 2013.
http://www.coretechint.com/technical_info-xps.php
http://www.intlsensor.com/pdf/electrochemical.pdf
https://chem.libretexts.org/Bookshelves/Analytical_Chemistry/Book%3A_Physical_Methods_in_Chemistry_and_Nano_Science_(Barron)/09%3A_Surface_Morphology_and_Structure/9.3%3A_SEM_and_its_Applications_for_Polymer_Science
https://chemistry.oregonstate.edu/courses/ch361-464/ch362/irinstrs.htm
https://commons.wikimedia.org/wiki/File:Schematic_of_UV_visible_spectrophotometer.png
https://instrumentationtools.com/catalytic-type-gas-sensor-principle
https://sites.google.com/site/frontierlab2011/scannig-electron-microscope/principie-of-sem
Hu,N., Yang,Z., Wang,Y., Zhang,L., Wang,Y., Huang,X., Wei,H., Wei,L., and Zhang,Y., (2013), "Ultrafast and sensitive room temperature NH_3 gas sensors based on chemically reduced graphene oxide", *Nanotechnology*, Vol. 25, pp. 025502, 2013.
Hu,Y., Tsai,H.L., and Huang,C.L., (2003), "Phase Transformation of Precipitated TiO_2 Nanoparticles", *Materials Science and Engineering A,* Vol. 344(1-2), pp. 209-214, 2003.
Huang,B.-R., and Lin,J.-C., (2012), "Core−Shell Structure of Zinc Oxide/Indium Oxide Nanorod Based Hydrogen Sensors", *Sensors and Actuators B*, Vol. 174, pp. 389−393, 2012.
Huang,J., and Wan,Q., (2009) "Gas Sensors Based on Semiconducting Metal Oxide One-Dimensional Nanostructures", *Sensors,* Vol. 9, pp. 9903-9924, 2009.
Hulanicki,A., Glab,S., and Ingman,F., (1991), "Chemical sensors definitions and classification", *Pure and Applied Chemistry*, Vol. 63, pp. 1247-1250, 1991.
Hung,N.L., Ahn,E., Park,S., Jung,H., Kim,H., Hong,S.K., and Kim,D., (2009), "Synthesis and hydrogen gas sensing properties of ZnO wirelike thin films", *Journal of Vacuum Science & Technology A,* Vol.27, pp.1347-1351, 2009.
Jaisutti,R., Lee,M., Kim,J., Choi,S., Ha,T.-J., Kim,J., Kim,H., Park,S.K., and Kim,Y.-H., (2017), "Ultrasensitive Room-Temperature Operable Gas Sensors Using *P*-Type Na:Zno Nanoflowers for Diabetes Detection", *ACS Applied Materials & Interfaces*, Vol. 9, pp. 8796-8804, 2017.
Jia,J., Yamamoto,H., Okajima,T., and Shigesato,Y., (2016), "On the Crystal Structural Control of Sputtered TiO_2 Thin Films", *Nanoscale Research Letters*, Vol. 11, pp. 324, 2016.

Jiang,J., Shi,L., Xie,T., Wang,D., and Lin,Y., (2018), "Study on the Gas-Sensitive Properties for Formaldehyde Based on SnO_2-ZnO Heterostructure in UV Excitation", *Sensors and Actuators B*, Vol. 254, pp. 863-871, 2018.
Jiang,Y., Raliya, R., Liao,P., Biswas,P., and Fortner,J.D., (2017), "Graphene Oxides in Water: Assessing Stability as a Function of Material and Natural Organic Matter Properties", *Environmental Science.: Nano,* Vol. 4, pp. 1484−1493, 2017.
Jiang,Y., Raliya,R., Fortner,J.D., and Biswas,P., (2016), "Graphene Oxides in Water: Correlating Morphology and Surface Chemistry with Aggregation Behavior", *Environmental Science and Technology*, Vol. 50, pp. 6964−6973, 2016.
Jiang,Y., Raliya,R., Liao,P., Biswas,P., and Fortner,J.D., (2017), "Graphene oxides in water: assessing stability as a function of material and natural organic matter properties", *Environmental Science: Nano*, Vol. 4, pp. 1484–93, 2017.
Jie,X., Zeng,D., Zhang,J., Xu,K., Wu,J., Zhu,B., and Xie,C., (2015), "Graphene-wrapped WO_3 nanospheres with room temperature NO_2 sensing induced by interface charge transfer", *Sensors and Actuators B,* Vol. 220, pp. 201–09, 2015.
Ju,D.-X., Xu,H.-Y., Qiu,Z.-W., Zhang,Z.-C., Xu,Q., Zhang,J., Wang,J.-Q., and Cao,B.-Q., (2015), "Near Room Temperature, Fast-Response, and Highly Sensitive Triethylamine Sensor Assembled with Au-Loaded ZnO/SnO_2 Core–Shell Nanorods on Flat Alumina Substrates", *ACS Applied Materials & Interfaces,* Vol. 7, pp. 19163-19171, 2015.
Kadir,R.A., Zhang,W, Wang,Y., Ou,J.Z., lodarski,W., O'Mullane,A., Bryant,G., Taylor,M., and Kalantar-zadeh,K., (2015), "Anodized nanoporous WO_3 Schottky contact structures for hydrogen and ethanol sensing", *Journal of Materials Chemistry A*", Vol. 3, pp. 7994-8001, 2015.
Kandasamy,S., Trinchi,A., Ghantasala,M.K., Peaslee,G.F, Holland,A., Wlodarski,W., and Comini,E., (2013), "Characterization and testing of Pt/TiO_2/SiC thin film layered structure for gas sensing", *Thin Solid Films,* Vol. 542, pp. 404–408, 2013.
Kathiravan,D., Huang,B.-R., and Saravanan,A., (2017), "Self-Assembled Hierarchical Interfaces of ZnO Nanotubes/Graphene Heterostructures for Efficient Room Temperature Hydrogen Sensors", *ACS Applied Materials & Interfaces,* Vol. 9, pp. 12064−12072, 2017.
Katoch,A., Kim,J.-H., Kwon,Y.J., Kim,H.W., and Kim,S.S., (2015), "Bifunctional Sensing Mechanism of SnO_2–ZnO Composite Nanofibers for Drastically Enhancing the Sensing Behavior in H_2 Gas", *ACS Applied Materials & Interfaces*, Vol. 7, pp. 11351-11358, 2015.
Kim,J., Kim,H., and Yun,J., (2017), "Improvement of gas sensing properties of carbon nanofibers based on polyacrylonitrile and pitch by steam activation", *Carbon Letters*, Vol. 24, pp. 36-40, 2017.
Kim,J.-H., Lee,J.-H., Park,Y., Kim,J.-Y., Mirzaei,A., Kim,H.W., and Kim,S.S., (2019), "Toluene- and Benzene-Selective Gas Sensors Based on Pt- and Pd-Functionalized ZnO Nanowires in Self-Heating Mode", *Sensors and Actuators B*, Vol. 294, pp. 78-88, 2019.
Kim,J.H., Mirzaei,A., Kim,H.W., and Kim,S.S., (2019), "Improving the hydrogen sensing properties of SnO_2 nanowire-based conductometric sensors by Pd-decoration", *Sensors and Actuators B*, Vol. 285, pp. 358–367, 2019.
Kim,J.-H., Mirzaei,A., Woo Kim, H., Wu,P., Kim,S.S., (2019), "Design of Supersensitive and Selective ZnO-Nanofiber-Based Sensors for H_2 Gas Sensing by Electron-Beam Irradiation", *Sensors and Actuators B,* Vol. 293, pp. 210-223, 2019.
Kim,J.-H., Mirzaei,A., Woo Kim,H., and Kim,S.S., (2019), "Combination of Pd Loading and Electron Beam Irradiation for Superior Hydrogen Sensing of Electrospun ZnO Nanofibers", *Sensors and Actuators B*, Vol. 284, pp. 628-637, 2019.
Kobrinsky,V., Rothschild,A., Lumelsky,V., Komem,Y., Lifshitz,Y., (2008), "Tailoring the gas sensing properties of ZnO thin films through oxygen nonstoichiometry, *Applied Physics Letter*, Vol. 93, pp. 113502, 2008.
Kofstad,P., (1972), "Nonstoichiometry, Diffusion and Electrical Conductivity in Binary Metal Oxides", *J. Willey & Sons Inc.*, New York, Lobdon, Sydney, Toronto, pp. 175, 1972.
Kolmakov,A., Klenov,D.O., Lilach,Y., Stemmer,S., and Moskovits,M., (2005), "Enhanced Gas Sensing by Individual SnO_2 Nanowires and Nanobelts Functionalized with Pd Catalyst Particles", Nano Letters, Vol. 5, pp. 667-673, 2005.
Kondalkar,V.V., Duy,L.T., Seo,H., and Lee,K., (2019), "Nanohybrids of Pt-Functionalized Al_2O_3/ZnO Core-Shell Nanorods for High-Performance MEMS-Based Acetylene Gas Sensor", ACS Applied Materials & Interfaces, doi.org/10.1021/acsami.9b06338.
Korotcenkov,G., (2007), "Metal Oxides for Solid-State Gas Sensors: What Determines Our Choice?", *Materials Science and Engineering: B,* Vol. 139, pp. 1-23, 2007.
Korotcenkov,G., (2008), "The role of morphology and crystallographic structure of metal oxides in response of conductometric-type gas sensors", *Materials Science and Engineering: R: Reports,* Vol. 61, pp. 1-39, 2008.

Korotcenkov,G., and Cho,B.K., (2011), "Instability of metal oxide-based conductometric gas sensors and approaches to stability improvement (short survey)", *Sensors and Actuators B*, Vol. 156, pp. 527–538, 2011.
Kumar,M.K., and Ramaprabhu,S., (2006), "Nanostructured Pt functionlized multiwalled carbon nanotube based hydrogen sensor", *The Journal of Physical Chemistry B*, Vol. 110, pp. 11291–11298, 2006.
Kumar,R., Al-Dossary,O., Kumar,G. and Umar,A., (2015), "Zinc oxide nanostructures for NO_2 gas-sensor applications: a review", *Nano-Micro Letters*, Vol.7, pp.97-120, 2015.
Lakhtakia.A., and Martín-Palma,R.J., (2013), *Engineered Biomimicry*, 2013.
Le,T.K., Kang,M., and Kim,S.W., (2019), "A review on the optical characterization of V_2O_5 micro-nanostructures", *Ceramics International*, Vol. 45, pp. 15781–15798, 2019.
Lee,J.-H., Katoch,A., Choi,S.-W., Kim,J.-H., Kim,H.W., and Kim,S.S., (2015), "Extraordinary Improvement of Gas-Sensing Performances in SnO_2 Nanofibers Due to Creation of Local p−n Heterojunctions by Loading Reduced Graphene Oxide Nanosheets", *ACS Applied Materials & Interfaces*, Vol. 7, pp. 3101−3109, 2015.
Lee,K., Baek,D.H., Na,H., Choi,J., and Kim,J., (2018), "Simple fabrication method of silicon/tungsten oxide nanowires heterojunction for NO_2 gas sensors", *Sensors and Actuators B*, Vol. 265, pp. 522–28, 2018.
Li,C.C., Du,Z.F., Li,L.M., Yu,H.C., Wan,Q., and Wang,T.H., (2007), "Surface-depletion controlled gas sensing of ZnO nanorods grown at room temperature", *Applied Physics Letters*, Vol. 91, pp. 032101, 2007.
Li,X.J., Chen,S.J., and Feng,C.Y., (2007), "Characterization of silicon nanoporous pillar array as room-temperature capacitive ethanol gas sensor", *Sensors and Actuators B*, Vol. 123, pp. 461–465, 2007.
Li,Z., Deen,M.J., Kumar,S., and Selvaganapathy,P.R., (2014), "Raman Spectroscopy for In-Line Water Quality Monitoring — Instrumentation and Potential", *Sensors,* Vol. 14, pp. 17275-17303, 2014.
Li,Z., Ding,D., Liu,Q., Ning,C., and Wang,X., (2014), "Ni−doped TiO_2 nanotubes for wide−range hydrogen sensing", *Nano Research Letters*, Vol. 9, pp. 118, 2014.
Liao,L., Lu,H.B., Li,J.C., Liu,C., Fu,D.J., Liu,Y.L., (2007), "The Sensitivity of Gas Sensor Based on Single ZnO Nanowire Modulated by Helium Ion Radiation", *Applied Physics Letters,* Vol. 91, pp. 173110, 2007.
Liao,L., Zheng,M., Zhang,Z., Yan,B., Chang,X., Ji,G., Shen,Z., Wu,T., Cao,J., Zhang,J., Gong,H., Cao,J., Yu,T., (2009), "The characterization and application of p-type semiconducting mesoporous carbon nanofibers, *Carbon*, Vol. 47, pp. 1841–1845, 2009.
Lin,Z., Li,N., Chen,Z., and Fu,P., (2017), "The effect of Ni doping concentration on the gas sensing properties of Ni doped SnO_2", *Sensors and Actuators B*, Vol. 239, pp. 501–510, 2017.
Ling,Y., Ren,F., Feng,J. (2016), "Reverse bias voltage dependent hydrogen sensing properties on Au-TiO_2 nanotubes Schottky barrier diodes", *International Journal of Hydrogen Energy,* Vol. 41, pp. 7691-7698, 2016.
Liu,J., Li,S., Zhang,B., Xiao,Y., Gao,Y., Yang,Q., Wang,Y., and Lu,G., (2017), "Ultrasensitive and Low Detection Limit of Nitrogen Dioxide Gas Sensor Based on Flower-Like ZnO Hierarchical Nanostructure Modified by Reduced Graphene Oxide", *Sensors and Actuators B*, Vol. 249, pp. 715−724, 2017.
Liu,S., Yu,B., Zhang,H., Fei,T., and Zhang,T., (2014), "Enhancing NO_2 Gas Sensing Performances at Room Temperature Based on Reduced Graphene Oxide-ZnO Nanoparticles Hybrids", *Sensors and Actuators B,* Vol. 202, pp. 272-278, 2014.
Liu,X., Cheng,S., Liu,H., Hu,S., Zhang,D., Ning,D., (2012), "A Survey on Gas Sensing Technology", *Sensors,* Vol. 12, pp. 9635-9665, 2012.
Liu,X., Cui,J.S., Sun,J.B., and Zhang,X.T., (2014), "3D graphene aerogel-supported SnO_2 nanoparticles for efficient detection of NO_2", *RSC Advance*, Vol. 4, pp. 22601–22605, 2014.
Liu,X., Wang,W., Zhang,Y., Pan,Y., Liang,Y., and Li,J., (2018), "Enhanced Sensitivity of a Hydrogen Sulfide Sensor Based on Surface Acoustic Waves at Room Temperature", *Sensors,* Vol. 18, pp. 3796, 2018.
Liu,Y., Hang,T., Xie,Y., Bao,Z., Song,J., Zhang,H., and Xie,E., (2011), "Effect of Mg doping on the hydrogen sensing characteristics of ZnO thin films", *Sensors and Actuators B,* Vol. 160, pp. 266–270, 2011.
Liu,Y., Parisi,J., Sun,X., and Lei,Y., (2014), "Solid-state gas sensors for high temperature applications—a review", *Journal of Materials Chemistry A,* Vol. 2, pp. 9919–43, 2014.
Liu,Z., Yamazaki,T., Shen,Y., Kikuta,T., Nakatani,N., and Kawabata,T., (2007), "Room temperature gas sensing of p-type TeO_2 nanowires", *Applied Physics Letters,* Vol. 90, pp. 173119, 2007.
Long,H., Shi,T., Hu,H., Jiang,S., Xi,S., Tang,Z., (2014), "Growth of hierarchal mesoporous NiO nanosheets on carbon cloth as binder-free anodes for high-performance flexible lithium-ion batteries", *Scientific Reports*, pp. 1–4, 2014.
Lu,G., Xu,J., Sun,J., Yu,Y., Zhang,Y., and Liu,F., (2012), "UV-Enhanced Room Temperature NO_2 Sensor Using ZnO Nanorods Modified with SnO_2 Nanoparticles", *Sensors and Actuators B*, Vol. 162, pp. 82-88, 2012.
Lupan,O., Chow, L., Pauporte,T., Ono,L.K., Cuenya,B.R., Chai,G., (2012), "Highly sensitive and selective hydrogen single-nanowire nanosensor", *Sensors and Actuators B*, Vol. 173, pp. 772-780, 2012.
Lupan,O., Postica,V., Labat,F., Ciofini,I., Pauporté,T., and Adelung,R., (2018), "Ultra-Sensitive and Selective Hydrogen Nanosensor with Fast Response at Room Temperature Based on a Single Pd/ZnO Nanowire", *Sensors and Actuators B*, Vol. 254, pp. 1259-1270, 2018.

Lupan,O., Schütt,F., Postica,V., Smazna,D., Mishra,Y.K., and Adelung,R., (2017), "Sensing Performances of Pure and Hybridized Carbon Nanotubes-ZnO Nanowire Networks: A Detailed Study", *Scientific Reports*, Vol. 7, pp. 14715, 2017.
Lupan,O., Ursaki,V.V., Chai,G., Chow,L., Emelchenko,G.A., Tiginyanu,I.M., Gruzintsev,A.N., and Redkin,A.N., (2010), "Selective hydrogen gas nanosensor using individual ZnO nanowire with fast response at room temperature", *Sensors and Actuators B*, Vol. 144, pp. 56-66, 2010.
Ma,X., Yuan,C., and Liu,X., (2014), "Mechanical, microstructure and surface characterizations of carbon fibers prepared from cellulose after liquefying and curing", *Materials*, Vol. 20, pp. 75–84., 2014.
Maciel,A.P., Lisboa-Filho,P.N., Leite,E.R., Paiva-Santos,C.O., Schreiner,W.H., Maniette,Y., and Longo,E., (2003). "Microstructural and Morphological Analysis of Pure and Ce-Doped Tin Dioxide Nanoparticles", *Journal of the European Ceramic Society*, Vol. 23, pp. 707-713, 2003.
Mani,G.K., and Rayappan,J.B.B., (2015), "A Highly Selective and Wide Range Ammonia Sensor—Nanostructured ZnO:Co Thin Film", *Materials Science and Engineering: B*, Vol. 191, pp. 41-50, 2015.
Maswanganye,M.W., Rammutla,K.E., Mosuang,T.E., and Mwakikunga,B.W., (2017), "The Effect of Co and In Combinational or Individual Doping on the Structural, Optical and Selective Sensing Properties of ZnO Nanoparticles", *Sensors and Actuators B,* Vol. 247, pp. 228-237, 2017.
Melitz,W., Shen,J., Kummel,A.C., and Lee,S., (2011), "Kelvin probe force microscopy and its application", *Surface Science Reports*, Vol. 66 (1), pp. 1–27, 2011.
Mendoza,F., Hernández,D.M., Makarov,V., Febus,E., Weiner,B.R., and Morell,G., (2014), "Room temperature gas sensor based on tin dioxide-carbon nanotubes composite films", *Sensors and Actuators B*, Vol. 190, pp. 227–233, 2014.
Modaberi,M.R., Rooydell,R., Brahma,S., Akande,A.A., Mwakikunga,B.W., and Liu,C.-P., (2018), "Enhanced Response and Selectivity of H_2S Sensing through Controlled Ni Doping into ZnO Nanorods by Using Single Metal Organic Precursors", *Sensors and Actuators B,* Vol. 273, pp. 1278-1290, 2018.
Modafferi,V., Panzera,G., Donato,A., Antonucci,P.L., Cannilla,C., Donato,N., Spadaro,D., and Neri,G., (2012), "Highly sensitive ammonia resistive sensor based on electrospun V_2O_5 fibers", *Sensors and Actuators B*, Vol. 163, pp. 61–68, 2012.
Mujahid,A., and Dickert,F.L., (2017), "Surface Acoustic Wave (SAW) for Chemical Sensing Applications of Recognition Layers", *Sensors*, Vol. 17, pp. 2716, 2017.
Nalimova,S.S., Myakin,S.V., Moshnikov,V.A., (2016), "Controlling Surface Functional Composition and Improving the Gas-Sensing Properties of Metal Oxide Sensors by Electron Beam Processing", *Glass Physics and Chemistry*, Vol. 42, pp. 597-601, 2016.
Neri,G., (2015), "First Fifty Years of Chemoresistive Gas Sensors", Chemosensors, Vol. 3, pp. 1-20, 2015.
Neto,A.H.C, Guinea,F., Peres,N.M.R., Novoselov,K.S., and Geim,A.K., (2009), "The electronic properties of graphene", *Reviews of Modern Physics*, Vol. 81 (1), pp. 109-162, 2009.
Ozgur,U., Alivov,Y.I., Liu,C., Teke,A., Reshchikov,M.A., Dogan,S., Avrutin,V., Cho,S.-J., and Morkoç,H., (2005), "A comprehensive review of ZnO materials and devices, *Journal of Applied Physics*, Vol. 98(4), pp. 041301, 2005.
Ozgur,U., Hofstetter,D., and Morkoc,H., (2010), "ZnO Devices and Applications: A Review of Current Status and Future Prospects", *Proceedings of the IEEE*, Vol. 98, pp. 1255 – 1268, 2010.
Pandis,C., Brilis,N., Bourithis,E., Tsamakis,D., Ali,H., Krishnamoorthy,S., Iliadis,A.A., and Kompitsas,M., (2007), "Low–Temperature Hydrogen Sensors Based on Au Nanoclusters and Schottky Contacts on ZnO Films Deposited by Pulsed Laser Deposition on Si and SiO_2 Substrates", *IEEE sensors journal*, Vol. 7, pp. 448-454, 2007.
Park,S., (2019), "Enhancement of hydrogen sensing response of ZnO nanowires for the decoration of WO_3 nanoparticles", *Materials Letters*, Vol. 234, pp. 315–318, 2019.
Park,S., Sun,G.-J., Jin,C., Kim,H. W., Lee,S., and Lee,C., (2016), "Synergistic Effects of a Combination of Cr_2O_3-Functionalization and UV-Irradiation Techniques on the Ethanol Gas Sensing Performance of ZnO Nanorod Gas Sensors", *ACS Applied Materials & Interfaces*, Vol. 8, pp. 2805-2811, 2016.
Pati,S., Banerji,P., and Majumder,S.B., (2015), "Properties of indium doped nanocrystalline ZnO thin films and their enhanced gas sensing performance", *RSC Advance*, Vol. 5, pp. 61230–61238, 2015.
Punginsang,M., Wisitsoraat,A., Sriprachuabwong,C., Phokharatkul,D., Tuantranont,A., Phanichphant,S., and Liewhiran,C., (2017), "Roles of Cobalt Doping on Ethanol-Sensing Mechanisms of FlameSpray-Made SnO_2 Nanoparticles−Electrolytically Exfoliated Graphene Interfaces", *Applied Surface Science*, Vol. 425, pp. 351−366, 2017.
Radzimska,A.K., and Jesionowski,T., (2014), "Zinc Oxide—From Synthesis to Application: A Review, *Materials*, Vol. 7, pp. 2833–2881, 2014.
Rahbrarpour,S., and Hosseini-Golgoo,S.M., (2013), "Di*ode type Ag-TiO_2 hydrogen sensors", Sensors and Actuators B, Vol. 187, pp. 262-266, 2013.*

Rai,P., Kim,Y.-S., Song,H.-M., Song,M.-K., Yu, and Y.-T., (2012), "The Role of Gold Catalyst on the Sensing Behavior of ZnO Nanorods for CO and NO_2 Gases", *Sensors and Actuators B*, Vol. 165, pp.133-142, 2012.
Rakhshani,A.E., Makdisi,Y., Mathew,X., and Mathews,N., (1998), "Charge Transport Mechanisms in Au-CdTe Space-Charge-Limited Schottky Diodes", *Physica Status Solidi A,* Vol. 168, pp. 177-187, 1998.
Raliya,R., Avery,C., Chakrabarti,S., and Biswas,P., (2017), "Photocatalytic degradation of methyl orange dye by pristine titanium dioxide, zinc oxide, and graphene oxide nanostructures and their composites under visible light irradiation", *Applied Nanoscience*, Vol. 7, pp. 253–59, 2017.
Ranwa,S., Kulriya,P.K., Dixit,V., and Kumar,M., (2014), "Temperature dependent electrical transport studies of self-aligned ZnO nanorods/Si heterostructures deposited by sputtering", *Journal of Applied Physics*, Vol. 115, pp. 233706, 2014.
Ranwa,S., Kulriya,P.K., Sahu,V.K., Kukreja,L.M., and Kumar,M., (2014), "Defect-free ZnO nanorods for low temperature hydrogen sensor applications", *Applied Physics Letters*, 105, 213103 (2014)
Ranwa,S., Kumar,M., Kulriya,P.K., Fanetti,M., Valant,M., Kumar,M., (2016), "Improvement in the Sensing Response of Nano-Crystalline ZnO-Based Hydrogen Sensor: Effect of Swift Heavy Ion Irradiation", *IEEE Sensors Journal*, Vol. 16, pp. 7586-7592, 2016.
Ranwa,S., Kumar,M., Singh,J., Fanetti,M., and Kumar,M., (2015), "Schottky-contacted vertically self-aligned ZnO nanorods for hydrogen gas nanosensor applications", *Journal of Applied Physics*, Vol. 118, pp. 034509, 2015.
Reinert,F., and Hüfner,S., (2005), "Photoemission spectroscopy—from early days to recent applications, *New Journal of Physics*, Vol. 7, pp. 97, 2005.
Renitta,A., and Vijayalakshmi,K., (2016), "Highly Sensitive Hydrogen Safety Sensor Based on Cr Incorporated ZnO Nano-Whiskers Array Fabricated on ITO Substrate", *Sensors and Actuators B*, Vol. 237, pp. 912-923, 2016.
Rothschild,A., and Komem,Y., (2004), "The Effect of Grain Size on the Sensitivity of Nanocrystalline Metal-Oxide Gas Sensors", *Journal of Applied Physics*, Vol. 95, pp. 6374-6380, 2004.
Russo,P.A., Donato,N., Leonardi,S.G., Baek,S., Conte,D.E., Neri,G., and Pinna,N., (2012), "Room-Temperature Hydrogen Sensing with Heteronanostructures Based on Reduced Graphene Oxide and Tin Oxide", *Angewandte Chemie International Edition*, Vol. 51, pp. 11053−11057, 2012.
Saaedi,A., and Yousefi,R., (2017), "Improvement of Gas-Sensing Performance of ZnO Nanorods by Group-I Elements Doping", *Journal of Applied Physics*, Vol. 122, pp. 224505, 2017.
Sadek,A.Z., Choopun,S., Wlodarski,W., Ippolito,S.J., and Zadeh,K.K., (2007), "Characterization of ZnO nanobelt-based gas sensor for H_2, NO_2, and hydrocarbon sensing", *IEEE Sensor Journal*, Vol. 7, pp. 919–924, 2007.
Sansone,F.J., (1992), "Fuel Cell Hydrogen Sensor for Marine Applications", *Marine Chemistry*, Vol. 37, pp. 3-14, 1992.
Saravanan,A., Huang,B.-R., Kathiravan,D., and Prasannan,A., (2017), "Natural Biowaste-Cocoon-Derived Granular Activated Carbon-Coated ZnO Nanorods: A Simple Route to Synthesizing a Core–Shell Structure and Its Highly Enhanced UV and Hydrogen Sensing Properties", *ACS Applied Materials & Interfaces*, Vol. 9, pp. 39771-39780, 2017.
Schütt,F., Postica,V., Adelung,R., and Lupan,O., (2017), "Single and Networked ZnO–CNT Hybrid Tetrapods for Selective Room-Temperature High-Performance Ammonia Sensors", *ACS Applied Materials & Interfaces*, Vol. 9, pp. 23107-23118, 2017.
Seiyama,T.; and ,A, (1962), "A new detector for gaseous components using semiconductor thin film", *Analytical Chemistry*, Vol. 34, pp. 1502–1503, 1962.
Seredych,M., Jurcakova,D.H., Lu,G.Q., and Bandosz,T.J., (2008), "Surface functional groups of carbons and the effects of their chemical character, density and accessibility to ions on electrochemical performance", *Carbon*, Vol. 46, pp. 1475–1488, 2008.
Sett,D., and Basak,D., (2017), "Highly enhanced H_2 gas sensing characteristics of Co:ZnO nanorods and its mechanism", *Sensors and Actuators B*, Vol. 243, pp. 475–483, 2017.
Sheats,J.R., and Smith,B.W., (2007), "Microlithography: Science and Technology", *CRC Press*, 2nd Edition, 2007.
Shen,Y., Yamazaki,T., Liu,Z., Meng,D., Kikuta,T., Nakatani,N., Saito,M., and Mori,M., (2009), "Microstructure and H_2 gas sensing properties of undoped and Pd –doped SnO_2 nanowires", *Sensors and Actuators B*, Vol. 135, pp. 524–529, 2009.
Singh,A., Sharma,A., Tomar,M., and Gupta,V., (2017), "Reduced Graphene Oxide-SnO_2 Nanocomposite Thin Film Based CNG/PNG Sensor", *Sensors and Actuators B*, Vol. 245, pp. 590−598, 2017.
Singh,E., Meyyappan,M., and Nalwa,H.S., (2017), "Flexible graphene-based wearable gas and chemical sensors", *ACS Applied Materials & Interfaces*, Vol. 9, pp. 34544–34586, 2017.

Singh,G., Virpal, and Singh,R.C., (2019), "Highly sensitive gas sensor based on Er-doped SnO_2 nanostructures and its temperature dependent selectivity towards hydrogen and ethanol", *Sensors and Actuators B*, Vol. 282, pp. 373–383, 2019.
Soo,M.T., Cheong,K.Y., and Noor,A.F.M., (2010), "Advances of SiC-based MOS capacitor hydrogen sensors for harsh environment applications", *Sensors and Actuators B*, Vol. 151, pp. 39-55, 2010.
Stankova,M., Vilanova,X., Llobet,E., Calderer,J., Bittencourt,C., Pireaux,J.J., and Correig,X., (2005), "Influence of the annealing and operating temperatures on the gas-sensing properties of RF sputtered WO_3 thin-film sensors", *Sensors and Actuators B*, Vol. 105, pp. 271–77, 2005.
Sun,Y.F., Liu,S.B., Meng,F.L., Liu,J.Y., Jin,Z., Kong,L.T., and Liu,J.H., (2012), "Metal Oxide Nanostructures and Their Gas Sensing Properties: A Review", *Sensors*, Vol. 12, pp. 2610-2631, 2012.
Surnev,S., Ramsey,M.G., and Netzer,F.P, (2003), "Vanadium oxide surface studies", *Progress in Surface Science*, Vol. 73, pp. 117–165, 2003.
Taguchi,N., (1971), "Gas Detecting Devices", U.S. Patent, 3,631,436, 28 December 1971.
Tamaekonga,N., Liewhiran,C., Wisitsoraat,A., Tuantranont,A., and Phanichphant,S., (2014), "NO_2 sensing properties of flame-made MnO_x-loaded ZnO-nanoparticle thick film", *Sensors and Actuators B*, Vol. 204, pp. 239–49, 2014.
Tammanoon,N., Wisitsoraat,A., Sriprachuabwong,C., Phokharatkul,D., Tuantranont,A., Phanichphant,S., and Liewhiran,C., (2015), "Ultrasensitive NO_2 sensor based on ohmic metal-semiconductor interfaces of electrolytically exfoliated graphene/flame-spray-made SnO_2 nanoparticles composite operating at low temperatures", *ACS Applied Materials and Interfaces*, Vol. 7, pp. 24338–52, 2015.
Tardy,P., Coulon,J.-R., Lucat,C., and Menil, F., (2004), "Dynamic thermal conductivity sensor for gas detection", *Sensors and Actuators B*, Vol. 98, pp. 63–68, 2004.
Tian,H., Fan,H., Guo,H., and Song,N., (2014), "Solution-Based Synthesis of ZnO/Carbon Nanostructures by Chemical Coupling for High Performance Gas Sensors", *Sensors and Actuators B*, Vol. 195, pp. 132-139, 2014.
Timmer,B., Olthuis,W., and Berg,AVD., (2005), "Ammonia sensors and their applications-a review", *Sensors and Actuators B*, Vol. 107, pp. 666-677, 2005.
Traversa,E., (1995), "Ceramic Sensors for Humidity Detection: The State-of-the-art and Future Developments", *Sensors and Actuators B*, Vol. 23, pp. 135-156, 1995.
Tsay,C.Y., Fan,K.S., and Lei,C.M., (2012), "Synthesis and characterization of sol-gel derived gallium-doped zinc oxide thin films", *Journal of Alloys and Compounds*, Vol. 512, pp. 216–222, 2012.
Van Quang,V., Dung,N.V., Trong,N.S., Hoa,N.D., Duy,N.V., and Hieu,N.V., (2014), "Outstanding Gas-Sensing Performance of Graphene/SnO_2 Nanowire Schottky Junctions", *Applied Physics Letter*, Vol. 105, pp. 013107, 2014.
Venkatesan,A., Ramesh,C.K., and Kannan,E.S., (2016), "In Situ Reduced Graphene Oxide Interlayer for Improving Electrode Performance in ZnO Nanorods", *Journal of Physics D: Applied Physics*, Vol. 49, pp. 245301, 2016.
Wales,D.J., Grand,J., Ting,V.P., Burke,R.D., Edler,K.J., Bowen,C.R., Mintova,S., and Burrows,A.D., (2015), "Gas Sensing Using Porous Materials for Automotive Applications", *Chemical Society Review*, Vol. 44, pp. 4290-4321, 2015.
Wang,B., Zheng,Z.Q., Zhu,L.F., Yang,Y.H., and Wu,H.Y., (2014), "Self-assembled and Pd decorated Zn_2SnO_4/ZnO wire-sheet shape nano-heterostructures networks hydrogen gas sensors", *Sensors and Actuators B*, Vol. 195, pp. 549–561, 2014.
Wang,C., Yin,L., Zhang,L., Xiang,D., and Gao,R., (2010), "Metal Oxide Gas Sensors: Sensitivity and Influencing Factors", *Sensors*, Vol. 10, pp. 2088-2106, 2010.
Wang,W., Li,Z., Zheng,W., Huang,H., Wang,C., and Sun,J., (2010), "Cr_2O_3-Sensitized ZnO Electrospun Nanofibers Based Ethanol Detectors", *Sensors and Actuators B*, Vol. 143, pp. 754-758, 2010.
Wang,Z., Liu,S., Jiang,T., Xu,X., Zhang,J., An,C., and Wang,C., (2015), "N-type SnO_2 nanosheets standing on p-type carbon nanofibers: a novel hierarchical nanostructures based hydrogen sensor", *RSC Advance*, Vol. 5, pp. 64582–64587, 2015.
Wang,Z., Tian,Z., Han,D., and Gu,F., 2016, "Highly Sensitive and Selective Ethanol Sensor Fabricated with In-Doped 3DOM ZnO", *ACS Applied Materials & Interfaces* 8, 5466-5474.
Wetchakun,K., Samerjai,T., Tamaekong,N., Liewhiran,C., Siriwong,C., Kruefu,V., Wisitsoraat,A., Tuantranont,A., and Phanichphant,S., (2011), "Semiconducting Metal Oxides as Sensors for Environmentally Hazardous Gases", *Sensors and Actuators B*, Vol. 160, pp. 580-591, 2011.
Wierzbowska,K., Bideux,L., Adamowicz,B., and Pauly,A., (2008), "A novel III–V semiconductor material for NO_2 detection and monitoring", *Sensors and Actuators A*, Vol. 142, pp. 237–41, 2008.
Wu,M.T., Yao,X., Yuan,Z.H., Sun,H.T., Wu,W.C., Chen,Q.H., and Xu,G.Y., (1993), "Effect of noble metal catalyst on titania exhaust gas oxygen sensor", *Sensors Actuators B,* Vol. 491, pp. 13-14, 1993.

Wunderlich,W., Oekermann,T., Miao,L., Hue,N.T., Tanemura,S., and Tanemura,M., (2004), "Electronic properties of Nano-porous TiO_2 and ZnO thin films- comparison of simulations and experiments", *Journal of Ceramic Processing Research*, Vol. 5, pp. 343–354, 2004.
Xia,Y., Wang,J., Xu,J.-L., Li,X., Xie,D., Xiang,L., and Komarneni,S., (2016), "Confined Formation of Ultrathin ZnO Nanorods/Reduced Graphene Oxide Mesoporous Nanocomposites for High-Performance Room-Temperature NO_2 Sensors", *ACS Applied Materials & Interfaces*, Vol. 8, pp. 35454−35463, 2016.
Xiao,Z., Kong,L.B., Ruan,S., Li,X., Yu,S., Li,X., Jiang,Y., Yao,Z., Ye,S., Wang,C., Zhang, T., Zhou,K., and Li,S., (2018), "Recent Development in Nanocarbon Materials for Gas Sensor Applications", *Sensors and Actuators B,* Vol. 274, pp. 235-267, 2018.
Xu,F., Lv,H.-F., Wu,S.-Y., and Ho,H.-P., (2018), "Light-Activated Gas Sensing Activity of ZnO Nanotetrapods Enhanced by Plasmonic Resonant Energy from Au Nanoparticles", *Sensors and Actuators B,* Vol. 259, pp. 709-716, 2018.
Yan,K., Kong,L.B., Dai,Y.H., Shi,M., Shen,K.W., Hu,B., and Kang,L., (2015), "Design and preparation of highly structure-controllable mesoporous carbons at the molecular level and their application as electrode materials for supercapacitors", *Journal of Materials Chemistry A*, Vol. 3, pp. 22781–22793, 2015.
Yang,X., Wang,W., Xiong,J., Chen,L., and Ma,Y, (2015), "ZnO:Cd Nanorods Hydrogen Sensor with Low Operating Temperature", *International Journal of Hydrogen Energy*, Vol. 40, pp. 12604−12609, 2015.
Yang,X., Zhang,S., Yu,Q., Zhao,L., Sun,P., Wang,T., Liu,F., Yan,X., Gao,Y., Liang,X., Zhang,S., and Lu,G., (2019), "One Step Synthesis of Branched SnO_2/ZnO Heterostructures and Their Enhanced Gas-Sensing Properties", *Sensors and Actuators B,* Vol. 281, pp. 415-423, 2019.
Yasrebi,N., Bagheri,B., Yazdanfar,P., Rashidian,B., and Sasanpour,P., (2014), "Optimization of Sputtering Parameters for the Deposition of Low Resistivity Indium Tin Oxide Thin Films", *Acta Metallurgica Sinica,* Vol. 27(2), pp. 324-330, 2014.
Yin,Z., Wu,S., Zhou,X., Huang,X., Zhang,Q., Boey,F., and Zhang,H., (2010), "Electrochemical Deposition of ZnO Nanorods on Transparent Reduced Graphene Oxide Electrodes for Hybrid Solar Cells", *Small*, Vol. 6, pp. 307−312, 2010.
Yoo,R., Güntner,A.T., Park,Y., Rim,H.J., Lee,H.-S., and Lee,W., (2019), "Sensing of Acetone by Al-Doped ZnO", *Sensors and Actuators B*, Vol. 283, pp. 107-115, 2019.
Yu,P., Zhao,X., Huang, Z., Li,Y., and Zhang,Q., (2014), "Free-standing three-dimensional graphene and polyaniline nanowire arrays hybrid foams for high-performance flexible and lightweight supercapacitors", *Journal of Materials Chemistry A*, Vol. 2, pp. 14413–20, 2014.
Yunusa,Z., Hamidon,M.N., Kaiser,A., and Awang,Z., (2014), "Gas Sensors: A Review, *Sensors & Transducers*, Vol. 168, pp. 61-75, 2014.
Zakrzewska,K., and Radecka,M., (2017), "TiO_2-Based nanomaterials for gas sensing -influence of anatase and rutile contributions", *Nanoscale Research Letter*, Vol. 12, pp. 89, 2017.
Zhang,D., Liu,Z., Li,C., Tang,T., Liu,X., Han,S., Lei,B., and Zhou,C., (2004), "Detection of NO_2 down to ppb levels using individual and multiple In_2O_3 nanowire devices", *Nano Letters*, Vol. 4, pp. 1919–24, 2004.
Zhang,D., Sun,Y., and Zhang,Y., (2015), "Fabrication and characterization of layer-by-layer nano self-assembled ZnO nanorods/carbon nanotube film sensor for ethanol gas sensing application at room temperature", *Journal of Materials Science: Materials in Electronics*, Vol. 26, pp. 7445–7451, 2015.
Zhang,J., Liu,X., Neri,G., and Pinna,N., (2016), "Nanostructured Materials for Room-Temperature Gas Sensors", *Advanced Materials*, Vol. 28, pp. 795-831, 2016.

Zhang,J., Lu,H., Zhang,L., Leng,D., Zhang,Y., Wang,W., Gao,Y., Lu,H., Gao,J., Zhu,G., Yang,Z., and Wang,C., (2019), "Metal–Organic Framework-Derived ZnO Hollow Nanocages Functionalized with Nanoscale Ag Catalysts for Enhanced Ethanol Sensing Properties", *Sensors and Actuators B*, Vol. 291, pp. 458-469, 2019.
Zhang,J., Qin,Z., Zeng,D., and Xie,C., (2017), "Metal-oxide-semiconductor based gas sensors: screening, preparation, and integration", *Physical Chemistry Chemical Physics*, Vol. 19, pp. 6313, 2017.
Zhang,J., Wu,J., Wang,X., Zeng,D., and Xie,C., (2017), "Enhancing room-temperature NO_2 sensing properties via forming heterojunction for NiO-rGO composited with SnO_2 nanoplates", *Sensors and Actuators B,* Vol. 243, pp. 1010–19, 2017.
Zhang,J., Zhu,Z., Chen,C., Chen,Z., Cai,M., Qu,B., Wang,T., and Zhang,M., (2018), "ZnO-Carbon Nanofibers for Stable, High Response, and Selective H_2S Sensors", *Nanotechnology,* Vol. 29, pp. 275501, 2018.
Zhang,L., Dong,B., Xu,L., Zhang,X., Chen,J., Sun,X., Xu,H., Zhang,T., Bai,X., Zhang,S., and Song,H., (2017), "Three-Dimensional Ordered ZnO–Fe_3O_4 Inverse Opal Gas Sensor toward Trace Concentration Acetone Detection", *Sensors and Actuators B*, Vol. 252, pp. 367-374, 2017.
Zhang,P., Shao,C., Zhang,Z., Zhang,M., Mu,J., Guo,Z., and Liu,Y., (2011), "In situ assembly of well-dispersed Ag nanoparticles (AgNPs) on electrospun carbon nanofibers (CNFs) for catalytic reduction of 4-nitrophenol", *Nanoscale*, Vol. 3, pp. 3357, 2011.

Zhang,Q., Xie,G., Xu,M., Su,Y., Tai,H., Du,H., and Jiang,Y., (2018), "Visible light-assisted room temperature gas sensing with ZnO-Ag heterostructure nanoparticles, *Sensors and Actuators B,* Vol. 259, pp. 269–281, 2018.
Zhang,X., Dong,Z., Liu,S., Shi,Y., Dong,Y., and Feng,W., (2017), "Maize Straw-Templated Hierarchical Porous ZnO:Ni with Enhanced Acetone Gas Sensing Properties", *Sensors and Actuators B,* Vol. 243, pp. 1224-1230, 2017.
Zhang,Y., Li,D., Qin,L., Zhao,P., Liu,F., Chuai,X.,Sun,P., Liang,X., Gao,Y., Sun,Y., and Lu,G., (2018), "Preparation and gas sensing properties of hierarchical leaf-like SnO_2 materials", *Sensors and Actuators B*, Vol. 255, pp. 2944–51, 2018.
Zhang,Y., Liu,Y., Zhou,L., Liu,D., Liu,F., Liu,F., Liang,X., Yan,X., Gao,Y., and Lu,G., (2018), "The Role of Ce Doping in Enhancing Sensing Performance of ZnO-Based Gas Sensor by Adjusting the Proportion of Oxygen Species", *Sensors and Actuators B*, Vol. 273, pp. 991-998, 2018.
Zhang,Y.-B., Yin,J., Li,L., Zhang,L.-X., and Bie,L.-J., (2014), "Enhanced Ethanol Gas-Sensing Properties of Flower-Like *p*-CuO/*n*-ZnO Heterojunction Nanorods", *Sensors and Actuators B*, Vol. 202, pp. 500-507, 2014.
Zhao,M., Wang,X., Ning,L., Jia,J., Li,X., and Cao,L., (2011), "Electrospun Cu-doped ZnO nanofibers for H_2S sensing", *Sensors and Actuators B*, Vol. 156, pp. 588–592, 2011.
Zhao,M., Wong,M.H., Man,H.C, and Ong,C.W., (2017), "Resistive hydrogen sensing response of Pd-decorated ZnO nanosponge film", *Sensors and Actuators B*, Vol. 249, pp. 624–631, 2017.
Zheng,J., Jiang,Z.-Y., Kuang,Q., Xie,Z.-X., Huang,R.-B., and Zheng,L.-S., (2009), "Shape-Controlled Fabrication of Porous ZnO Architectures and Their Photocatalytic Properties", *Journal of Solid State Chemistry*, Vol. 182, pp. 115-121, 2009.
Zheng,K., Gu,L., Sun,D., Mo,X., and Chen,G., (2010), "The Properties of Ethanol Gas Sensor Based on Ti Doped ZnO Nanotetrapods", *Materials Science and Engineering: B*, Vol. 166, pp. 104−107, 2010.
Zhiming,C., Sumei,Z., Tongyun,C., Yongping,D., Wangbing,Z., and Xiangfeng,C., (2012), "Acetic acid gas sensors based on Ni^{+2} doped ZnO nanorods prepared by using the solvothermal method", *Journal of Semiconductors,* Vol. 33, pp. 1–6, 2012.
Zhou,D.Y., Wang,G.Z., Li,W.S., and Li,G.L., Tan,C.L., Rao,M.M., and Liao,Y.H., (2008), "Preparation and performances of porous polyacrylonitrile–methyl methacrylate membrane for lithium-ion batteries", *Journal of Power Sources*, Vol. 184, pp. 477–480, 2008.
Zhu,B.L., Xie,C.S., Zeng,D.W., Song,W.L., and Wang,A.H., (2005), "Investigation of gas sensitivity of Sb-doped ZnO nanoparticles", *Materials Chemistry and Physics*, Vol. 89, pp. 148–153, 2005.