REFERENCES

[1] Zakrzewska, K. Mixed oxides as gas sensors. *Thin Solid Films.*, **2001**, 391, 229-238.

[2] Sberveglieri, G. Recent developments in semiconducting thin-film gas sensors. *Sensors and Actuators B: Chemical.*, **1995**, 23,103-109.

[3] Imawan, C.; Solzbacher, F.; Steffes, H. and Obermeier, E. Gas-sensing characteristics of modified-MoO_3 thin films using Ti-overlayers for NH_3 gas sensors. *Sensors and Actuators B: Chemical.*, **2000**, 64, 193-197.

[4] Tuma, P. Characteristics of semiconductor gas sensors I. Steady state gas response. *Sensors and Actuators B: Chemical.*, **1983**, 3, 233-254.

[5] Rajeev, K.; Srivastava, P.; Dwivedi, R.; and Srivastava, S.K. Sensing mechanism in tin oxide-based thick-film gas sensors. *Sensors and Actuators B: Chemical.*, **1994**, 21, 213-218.

[6] Drost, H. Tin oxide gas sensors: An analytical comparison of gas-sensitive and non-gas-sensitive thin films. *Sensors and Actuators B: Chemical.*, **1991**, 4, 463-466.

[7] Mizsei, J. How can sensitive and selective semiconductor gas sensors be made?. *Sensors and Actuators B: Chemical.*, **1995**, 23, 173-176.

[8] Delpha, C.; Siadat, M.; Lumbreras, M. Discrimination of a refrigerant gas in a humidity controlled atmosphere by using modelling parameters. *Sensors and Actuators B: Chemical.*, **2000**, 62, 226-232.

[9] Ampuero, S.; Bosset, J.O. The electronic nose applied to dairy products: a review. *Sensors and Actuators B: Chemical.*, **2003**, 94, 1-12.

[10] Natale, C.D.; Davide, F.; D'Amico,A. Pattern recognition in gas sensing: well-stated techniques and advances. *Sensors and Actuators B: Chemical.*, **1995**, 23, 111-118.

[11] Jerger, A.; Kohler, H.; Becker, F.; Keller, H.B. and Seifert, R. New applications of tin oxide gas sensors: II. Intelligent sensor system for reliable monitoring of ammonia leakages. *Sensors and Actuators B: Chemical.*, **2002**, 81, 301-307.

[12] Solzbacher, F.; Imawan,C.; Steffes, H.; Obermeier, E. and Eickhoff, M. A highly stable SiC based microhotplate NO_2 gas-sensor. *Sensors and Actuators B: Chemical.*, **2001**, 78, 216-220.

[13] Dücsö, C.; Ádám, M.; Szabó, I.; Bársony, I.; Gardeniers, J.G.E. and Van den Berg, A. Porous silicon bulk micromachining for thermally isolated membrane formation. *Sensors and Actuators A: Physical.*, **1997**, 60, 235-239.

[14] Dumitrescu, M.; Cobianu, C.; Lungu, D.; Dascalu, D.; Pascu, A.; Kolev, S. and Van den Berg, A. Thermal simulation of surface micromachined polysilicon hot plates of low power consumption. *Sensors and Actuators A: Physical.*, **1999**, 76, 51-56.

[15] Wang, X.; Miura, N. and Yamazoe, N. Study of WO_3-based sensing materials for NH_3 and NO detection. *Sensors and Actuators B: Chemical.*, **2000**, 66, 74-76.

[16] Xu, C.N.; Miura, N.; Ishida, Y.; Matsuda, K. and Yamazoe, N. Selective detection of NH_3 over NO in combustion exhausts by using Au and MoO_3 doubly promoted WO_3 element. *Sensors and Actuators B: Chemical.*, **2000**, 65, 163-165.

[17] Gopel, W. amd Schierbaum, K.D. SnO_2 sensors: Current status and future prospects. *Sensors and Actuators B: Chemical.*, **1995**, 26, 1-12.

[18] Wang, Y.D.; Wu, X.H.; Su, Q.; Li, Y.F. and Zhou, Z.L. Ammonia-sensing characteristics of Pt and SiO_2 doped SnO_2 materials. *Solid-State Electronics.*, **2001**, 45, 347-350.

[19] Lundström, I.; Spetz, A.; Sundgren, H and Winquist, F. From hydrogen sensors to olfactory images-twenty years with catalytic field-effect devices. *Sensors and Actuators B: Chemical.*, **1993**, 13, 16-23.

[20] Winquist, F. Determination of ammonia in air and aqueous samples with a gas-sensitive semiconductor capacitor. *Analytica Chimica Acta.*, **1984**, 164, 127-138.

[21] Lundström, I.; Winquist, A.S.; Ackelid, F.U. and Sundgren, H. Catalytic metals and field-effect devices-a useful combination. *Sensors and Actuators B: Chemical.*, **1990**, 1, 15-20.

[22] Mayo, N.; Harth, R.; Mor, U.; Marouani, D.; Hayon, J. and Bettelheim, A. Electrochemical response to H_2, O_2, CO_2 and NH_3 of a solid-state cell based on a cation- or anion-exchange membrane serving as a solid polymer electrolyte. *Analytica Chimica Acta.*, **1995**, 310, 139-144.

[23] Ghauch, A.; Rima, J.; Charef, A.; Suptil, J.; Fachinger, C. and Martin-Bouyer, M. Quantitative measurements of ammonium, hydrogenophosphate and Cu(II) by diffuse reflectance spectrometry. *Talanta.*, **1999**, 48, 385-392.

[24] Mount, G.H.; Rumburg, B.; Havig, J.; Lamb, B.; Westberg, H.; Yonge, D.; Johnson, K. and Kincaid, R. Measurement of atmospheric ammonia at a dairy using differential optical absorption spectroscopy in the mid-ultraviolet. *Atmospheric Environment.*, **2002**, 36, 1799-1810.

[25] Jin, Z.; Su, Y.; Duan, Y. Development of a polyaniline-based optical ammonia sensor. *Sensors and Actuators B: Chemical.*, **2001**, 72, 75-79.

[26] Lee, Y.S.; B.; Choi, N.J.; Lim, J.O.; Huh, J.S. and Lee, D.D. Visible optical sensing of ammonia based on polyaniline film. *Sensors and Actuators B: Chemical.*, **2003**, 93, 148-152.

[27] Lähdesmäki, I.; Lewenstam, A. and Ivaska, A. A polypyrrole-based amperometric ammonia sensor. *Talanta.*, **1996**, 43, 25-134.

[28] Kukla, A.L.; Shirshor, Y.M. and Piletsky, S.A. Ammonia sensors based on sensitive polyaniline films. *Sensors and Actuators B: Chemical.*, **1996**, 37, 135-140.

[29] Nicolas-Debarnot, D. and Poncin-Epaillard, F. Polyaniline as a new sensitive layer for gas sensors. *Analytica Chimica Acta.*, **2003**, 475, 1-15.

[30] Lähdesmäki, I.; Kubiak, W.W.; Lewenstam, A. and Ivaska, A. Interferences in a polypyrrole-based amperometric ammonia sensor. *Talanta.*, 2000, 52, 269-275.

[31] Palmqvist, E. and Kriz, C.B. DC-resistometric urea sensitive device utilizing a conducting polymer film for the gas-phase detection of ammonia. *Biosensors and Bioelectronics.*, **1995**, 10, 283-287.

[32] Lundström, G.G. The effect of ammonia on the physical properties of polypyrrole. *Synthetic Metals.*, **1987,** 21, 203-208.

[33] Brie, M.; Turcu, R.; Neamtu, C. and Pruneanu, S. The effect of initial conductivity and doping anions on gas sensitivity of conducting polypyrrole films to NH_3. *Sensors and Actuators B: Chemical.*, **1996**, 37, 119-122.

[34] Shenglong, W. Polymerization of substituted aniline and characterization of the polymers obtained. *Synthetic Metals.*, **1986**, 16, 99-104.

[35] Jeong, S.K.; Suh, J.S.; Oh, E.J.; Park, Y.W.; Kim, C.Y. and MacDiarmid, A.G. Preparation of polyaniline free standing film by controlled processing and its transport property. *Synthetic Metals.*, **1995**, 69, 171-172.

[36] Chan, H. and Ho, P.H. Polyaniline doped with phosphoric acid: their preparation and characterization. *Macromolecules.*, **1994**, 27, 2159-2164.

[37] Palanlappan, S. Temperature effect on conducting polyaniline salt. *Polymer Science.*, **1994**, 32, 2431-2436.

[38] Collins, G.E. and Buckley, L.J. Conductive polymer-coated fabrics for chemical sensing. *Synthetic Metals.*, **1996**, 78, 93-101.

[39] Ingleby, P.; Gardner, J.W. and Bartlett, P.N. Effect of micro-electrode geometry on response of thin-film poly(pyrrole) and poly(aniline) chemoresistive sensors. *Sensors and Actuators B: Chemical.*, **1999**, 57, 17-27.

[40] Kemp, N.T.; Kaiser, A.B.; Trodahl, H.J.; Chapman, B. Partridge, A.C. and Buckley, R.G. Temperature-dependent conductivity of conducting polymers exposed to gases. *Synthetic Metals.*, **1999**, 101, 434-435.

[41] Li, D.; Jiang, Y.; Wu, Z.; Chen, X. and Li, Y. Self-assembly of polyaniline ultrathin films based on doping-induced deposition effect and applications for chemical sensors. *Sensors and Actuators B: Chemical.*, **2000**, 66, 125-127.

[42] Chabukswar, V.V.; Pethker, S. and Atha, A.A. Acrylic acid doped polyaniline as an ammonia sensor. *Sensors and Actuators B: Chemical.*, **2001,** 77, 657-663.

[43] Selampinar, F.; Toppare, L.; Akbulut, U.; Yalçin, T. and Süzer, S. A conducting composite of polypyrrole II. As a gas sensor. *Synthetic Metals.*, **1995**, 68, 109-116.

[44] Matsuguchi, M.; Io, J.; Sugiyama, G. and Sakai, Y. Effect of NH_3 gas on the electrical conductivity of polyaniline blend films. *Synthetic Metals.*, **2002**, 128, 15-19.

[45] Hu, H.; Saniger, J.M. and Banuelos, J.G. Thin films of polyaniline–polyacrylic acid composite by chemical bath deposition. *Thin Solid Films.*, **1999**, 347, 241-247.

[46] Sharma, S.; Nirkhe, C.; Pethkar, S. and Athawale, A. A Chloroform vapour sensor based on copper/polyaniline nanocomposite. *Sensors and Actuators B: Chemical.*, **2002**, 85, 131-136.

[47] Musio, F.; Amrani, E.H. and Persaud, K.C. High-frequency a.c. investigation of conducting polymer gas sensors. *Sensors and Actuators B: Chemical.*, **1995**, 23, 223-226.

[48] Amrani, M.E.; Payne, P.A. and Persaud, K.C. Multi-frequency measurements of organic conducting polymers for sensing of gases and vapours. *Sensors and Actuators B: Chemical.*, **1996**, 33, 137-141.

[49] Amrani, M.E.H.; Payne, P.A.; Dowdeswell, R.M. and Hoffman, A.D. Frequency counting interrogation techniques applied to gas sensor arrays. *Sensors and Actuators B: Chemical.*, **1999**, 57, 75-82.

[50] Su, J.S. and Kuramoto, N. Synthesis of processable polyaniline complexed with anionic surfactant and its conducting blends in aqueous and organic system. *Synthetic Metals.*, **2000**, 108, 121-126.

[51] Riul Jr, A.; Gallardo Soto, A.M.; Mello, S.V.; Bone, S.; Taylor, D.M. and Mattoso, L.H.C. An electronic tongue using polypyrrole and polyaniline. *Synthetic Metals.*, **2003**, 132, 109-116.

[52] Yuan, G.L.; Kuramoto, N. and Su, S.J. Template synthesis of polyaniline in the presence of phosphomannan. *Synthetic Metals.*, **2002**, 129, 173-178.

[53] Castillo-Ortega, M.M.; Rodriguez, D.E.; Encinas, J.C.; Plascencia, M.; Méndez-Velarde, F.A. and Olayo, R. Conductometric uric acid and urea biosensor prepared from electroconductive polyaniline-poly(n-butyl methacrylate) composites. *Sensors and Actuators B: Chemical.*, **2002**, 85, 19-25.

[54] Koul, S.; Chandra, R. and Dhawan, S.K. Conducting polyaniline composite: a reusable sensor material for aqueous ammonia. *Sensors and Actuators B: Chemical.*, **2001**, 75, 151-159.

[55] Adhikari, S. and Adhikari, B. Polyvinyl alcohol: A taste sensing material. *Sensors and Actuators B: Chemical.*, **2006**, 114, 747-755.

[56] Stejskal, J.; Sapurina, I.; Proke, J and Zemek, J. In-situ polymerized polyaniline films. *Synthetic Metals.*, **1999**, 105, 195-202.

[57] Cruz, G.J.; Morales, J.; Castillo-Ortega, M.M. and Olayo, R. Synthesis of polyaniline films by plasma polymerization. *Synthetic Metals.*, **1997**, 88. 213-218.

[58] Lio, C. and Gu, M. Electroless deposition of polyaniline film via autocatalytic polymerization of aniline. *Thin Solid Films.*, **2002**, 408, 37-42.

[59] Swapna Rao, P.; Subrahmanya, S. and Sathyanarayana, D.N. Inverse emulsion polymerization: a new route for the synthesis of conducting polyaniline. *Synthetic Metals.*, **2002**, 128, 311-316.

[60] Dinesan, A.A. Review: Polyaniline-A novel polymeric material. *Talanta.*, **1991**, 38, 815-837.

[61] Malinauskas, A. Chemical deposition of conducting polymers. *Polymer.*, **2001**, 42, 3957-3972.

[62] Abrantes, L.M.; Correia, J.P.; Savic, M. and Jin, G. Structural modifications during conducting polymer formation-an ellipsometric study. *Electrochimica Acta.*, **2001**, 46, 3181-3187.

[63] Stejskal, J. and Gilbert, R.G. Polyaniline Preparation of Conducting Polymer. *Pure Application Chemistry.*, **2002**, 74, 857-867.

[64] Ram, M.K.; Mascetti, G.; Paddeu, S.; Maccioni, E and Nicolini, C. Optical, structural and fluorescence microscopic studies on reduced form of polyaniline: The leucoemeraldine base. *Synthetic Metals.*, **1997**, 89, 63-69.

[65] Heeger, A.J. Semiconducting and metallic polymers: the fourth generation of polymeric materials. *Synthetic Metals.*, **2002**, 125, 23-42.

[66] Athawale, A.A.; Kulkarni, M.V. and Chabukswar, V.V. Studies on chemically synthesized soluble acrylic acid doped polyaniline. *Materials Chemistry and Physics.*, **2002**, 73, 106-110.

[67] Ryu, K.S.; Moon, B.W.; Joo, J. and Chang, S.H. Characterization of highly conducting lithium salt doped polyaniline films prepared from polymer solution. *Polymer.*, **2001**, 42, 9355-9360.

[68] Meijerink, M.G.H.; Strike, D.J.; De Rooij, N.F. and Koudelka-Hep, M. Reproducible fabrication of an array of gas-sensitive chemo-resistors with commercially available polyaniline. *Sensors and Actuators B: Chemical.*, **2000**, 68, 331-334.

[69] Koul, S.; Dhawan, S.K. and Chandra, R. Compensated sulphonated polyaniline - correlation of processibility and crystalline structure. *Synthetic Metals.*, **2001**, 124, 295-299.

[70] Han, M.G.; Lee, Y.J.; Byun, S.W. and Im, S.S. Physical properties and thermal transition of polyaniline film. *Synthetic Metals.*, **2001**, 124, 337-343.

[71] Epstein, H.H. Conduction mechanism of polyaniline: Effect of moisture. *Synthetic Metals.*, **1988**, 26, 1-8.

[72] Athawale, A.A. Studies on chemically synthesized soluble acrylic acid doped polyaniline. *Materials Chemistry and Physics.*, **2002**, 73, 106-110.

[73] Bormashenko, E.; Pogreb, R.; Sutovski, S.; Shulzinger, A.; Sheshnev, A.; Izakson, G. and Katzir, A. Infrared optics applications of thin polyaniline emeraldine base films. *Synthetic Metals.*, **2004**, 140, 49-52.

[74] Kuzmany, H.N. In situ FTIR measurements of polyaniline in the non-metallic phase. *Synthetic Metals.*, **1989**, 29, 185-192.

[75] Tan, E.T. X-ray photoelectron spectroscopic characterization of protonation of polyaniline films by polymeric acids. *Polymer.*, **1994**,35, 3193-3199.

[76] Agbor, N.E.; Cresswell, J.P.; Petty, M.C. and Monkman, A.P. An optical gas sensor based on polyaniline Langmuir-Blodgett films. *Sensors and Actuators B: Chemical.*, **1997**, 41, 137-141.

[77] Prasad, G.K.; Radhakrishnan, T.P.; Sravan Kumar, D. and Chanashyam Krishna, M. Ammonia sensing characteristics of thin film based on polyelectrolyte templated polyaniline. *Sensors and Actuators B: Chemical.*, **2005**, 106, 626-631.

[78] Cradig, T.; Butler, T.; McCraith, B.D.; Diamond, D. and Anthony, M. Optical sensor for gaseous ammonia with tuneable sensitivity. *Analyst.*, **1997**, 122, 803-806.

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