

## References

- [1] Marc Tessier-Lavigne, "Phototransduction and Information Processing in the Retina" from *Principles of Neural Science*, E.R. Kandel, J.H. Schwarz, and T.M. Jessel, eds, New York: Elsevier, pp. 400-418, 1991.
- [2] Jane Dodd and Vincent F. Castellucci, "Smell and Taste: The Chemical Senses," from *Principles of Neural Science*, E.R. Kandel, J.H. Schwarz, and T.M. Jessel, eds, New York: Elsevier, pp. 512-529, 1991.
- [3] Stephen P. DeWeerth, "Analog VLSI Circuits for Stimulus Localization and Centroid Computation," *Intl Journal of Computer Vision*, vol. 8, no. 2, pp. 191-202, 1992.
- [4] David L. Standley, "An Object Position and Orientation IC with Embedded Imager," *IEEE Journal Solid-State Circuits*, Vol. 26, no. 12, pp. 1853-1858, Dec. 1991.
- [5] Stephen P. DeWeerth, "Converting Spatially Encoded Sensory Information to Motor Signals using Analog VLSI Circuits," *Autonomous Robotics*, accepted for publication.
- [6] Stephen P. DeWeerth and Tonia G. Morris, "Analog VLSI Circuits for Primitive Sensory Attention," *Proc Intl Symp Circuits and Systems*: London, England, pp. 507 - 510, June 1994.
- [7] Tonia G. Morris and Stephen P. DeWeerth, "Analog VLSI Arrays for Morphological Image Processing," *Intl Conf Application Specific Array Processors*: San Francisco, California, pp. 132-142, 1994.
- [8] J. Tanner and C. Mead, "An Integrated Optical Motion Sensor," *VLSI Signal Processing II*, S-Y Kung, R.E. Owen, and J.G. Nash, eds, New York: IEEE Press, pp. 59-76, 1986.
- [9] Jerome F. McAleer, Patrick T. Moseley, John O. Norris, and David E. Williams, "Tin Dioxide Gas Sensors," *Journal Chem Soc: Faraday Trans I*, Vol. 83, pp. 1323-1346, 1987.
- [10] Philip N. Bartlett, Patricia B.M. Archer, and Sim K. Ling-Chung, "Conducting Polymer Gas Sensors, Part 1: Fabrication and Characterization," *Sensors and Actuators B*, vol. 4, pp. 365-372, 1991.
- [11] Yoshihiko Nakatani, Michio Matsuoka, and Yoshio Iida, " $\gamma$ -Fe<sub>2</sub>O<sub>3</sub> Ceramic Gas Sensor," *IEEE Trans. on Components, Hybrids, and Manufacturing Tech*, vol. CHIMT-5, no. 4, December 1992.
- [12] Kousuke Ihokura and Joseph Watson, *The Stannic Oxide Gas Sensor: Principles and Applications*, CRC Press: Ann Arbor, Michigan, pp. 2-7, 1994.
- [13] J. Marshall, M. Gaitan, M. Zaghloul, D. Novtomy, V. Tyree, J.-I. Pi, C. Pina, and W. Hansford, "Realizing Suspended Structures on Chips Fabricated by CMOS Foundry Processes

Through the MOSIS Service," *National Institute of Standards and Technology: NISTIR #5402*, June 1994.

- [14] David A. Koester, Ramaswamy Mahadevan, and Karen W. Markus, "Multi-User MEMS Processes (MUMPs): Introduction and Design Rules," *MCNC Report, rev. 3*, October 1994.
- [15] P. Bergveld, "Development of an Ion-Sensitive Solid-State Device for Neurophysiological Measurements," *IEEE Trans Biomedical Eng*, vol. 17, pp. 70-71, January 1970.
- [16] K.I. Lundstrom, M.S. Shivaraman, and C.M. Svenson, "A hydrogen-sensitive Pd gate MOS transistor," *Journal App Physics*, vol. 46, no. 9, pp. 3876-3881, September 1975.
- [17] M. Stenberg and B. Dahlenback, "Surface-Accessible FET for Gas Sensing," *Sensors and Actuators*, vol. 4, pp. 273-281, 1983.
- [18] M. Joseowics and J. Janata, "Suspended Gate Field Effect Transistor Modified with Polypyrrole as Alcohol Sensor," *Anal Chem*, vol. 58, pp. 514-517, 1986.
- [19] Ingemar Lundstrom and Christer Svensson, "Gas-Sensitive Metal Gate Semiconductor Devices," *Solid State Chemical Sensors*, Jiri Jonata and Robert J. Huber, eds, Academic Press: New York, pp. 2-50, 1985.
- [20] Hans-Dieter Wiemhofer and Wolfgang Gopel, "Fundamentals and Principles of Potentiometric Gas Sensors Based upon Solid Electrolytes," *Sensors and Actuators B*, vol. 4, pp. 365-372, 1991.
- [21] G. Hoetzel and W. Weppner, "Potentiometric Gas Sensors Based on Fast Solid Electrolytes," *Sensors and Actuators*, vol. 12, pp. 449-453, 1987.
- [22] Jiri Janata, *Principles of Chemical Sensors*, Plenum Press: New York, Chapters 2,3, and 5, 1989.
- [23] B. Bott and T.A. Jones, "The Use of Multisensor Systems in Monitoring Hazardous Atmospheres," *Sensors and Actuators*, vol. 9, pp. 19-25, 1986.
- [24] R. Muller and E. Lange, "Multidimensional Sensors for Gas Analysis," *Sensors and Actuators*, vol. 9, pp. 39-48, 1986.
- [25] H. Meyer, H.Drewer, J. Karause, K. Cammann, R. Kakerow, Y. Manoli, W. Mokwa, and M. Rospert, "Chemical and biochemical sensor array for two-dimensional imaging of analyte distributions," *Sensors and Actuators B*, vol. 18-19, pp. 229-234, 1994.
- [26] Xiaodong Wang, Sinclair Yee, and Patrick Carey, "A Microfabricated Array of Multiple thin film metal-oxide sensors for multicomponent gas and vapor quantification, *IEEE Solid State Sensor and Actuators Workshop*: Hilton Head, South Carolina, pp. 23-26, 1992.
- [27] Chaonan Xu, Jun Tamaki, Nario Miura, and Noboru Yamazoe, "Grain Size effects of Gas Sensitivity of Porous SnO<sub>2</sub>-based Elements," *Sensors and Actuators B*, vol. 3, pp. 147-155, 1991.
- [28] T. Seiyama and N. Yamazoe, "Recent Advances in Gas Sensors in Japan," *ACS Symposium: Fundamental and Applications of Chemical Sensors*, pp. 39-50, 1986.

- [29] A. Ikegami and M. Kaneyasu, "Olfactory Detection Using Integrated Sensor," *Proc 3rd Intl Conf Solid-State Sensors and Actuators (Transducers '85)*: Philadelphia, Pennsylvania, USA, pp. 136-139, June 11-14, 1985.
- [30] H.V. Shurmer, J.W. Gardner, and P. Corcoran, "Intelligent Vapour Discrimination Using a Composite 12-Element Sensor Array, *Sensors and Actuators B*, vol. 4, pp. 256-260, 1990.
- [31] J.W. Gardner, H.V. Shurmer, and T.T. Tan, "Application of an electronic nose to the discrimination of coffees," *Sensors and Actuators B*, vol. 6, pp. 71-75, 1992.
- [32] J.W. Gardner, "Detection of Vapours and Odours from a Multisensor Array Using Pattern Recognition: Part 1: Principal Component and Cluster Analysis," *Sensors and Actuators B*, vol. 4, pp. 109-115, 1991.
- [33] P.S. Barker, J.R. Chen, N.E. Agbor, A.P. Monkman, P. Mars, and M.C. Petty, "Vapour Recognition using Organic films and Artificial Neural Networks," *Sensors and Actuators B*, vol. 17, pp. 143-147, 1994.
- [34] J. W. Gardner, T.C. Pearce, and S. Friel, "A Multisensor System for Beer Flavour Monitoring using an Array of Conducting Polymers and Predictive Classifiers," *Sensors and Actuators B*, vol. 18-19, pp. 240-243, 1994.
- [35] M. Hoummady, D. Hauden, B. Hivert, J. Henrion, P. Mielle, and P. Etievant, "SnO<sub>2</sub> Sensor Array for Flavour Recognition with Neural Networks," *Eurosensors VIII*: Toulouse, France, 1994.
- [36] M. Holmberg, I. Lundstrom, F. Winquist, J. Gardner, and E. Hines, "Identification of Paper Quality Using an Electronic Nose," *Eurosensors VIII*: Toulouse, France, 1994.
- [37] H. Sundren, F. Winquist, and I. Lundstrom, "Artificial Neural Networks and Statistical Pattern Recognition Improvement: MOSFET Gas Sensor Array Calibration," *Proc Intl Conf Solid-State Sensors and Actuators (Transducers '91)*: San Francisco, California, pp. 574-577, 1991.
- [38] Fabrizio M. Davide, Corrado Di Natale, and Arnaldo D'Amico, "Self-organizing Multisensor Systems for Odour Classification: Internal Categorization, Adaptation, and Drift Rejection," *Sensors and Actuators B*, vol. 18-19, pp. 244-250, 1994.
- [39] Julian W. Gardner, Timothy C. Parce, Sharon Friel, Philip N. Bartlett, and Neil Blair, "A Multisensor system for beer flavour monitoring using an array of conducting polymers and predictive classifiers," *Sensors and Actuators B*, vol. 18-19, pp. 240-243, 1994.
- [40] Evor L. Hiines and Julian W. Gardner, "An artificial neural emulator for an odour sensor array," *Sensors and Actuators B*, vol. 18-19, pp. 661-664, 1994.
- [41] N. Najafi, K.D. Wise, R. Merchant, and J.W. Schwank, "An Integrated Multi-Element Ultra-thin film gas analyzer," *IEEE Workshop Solid-State Sensors and Actuators*: Hilton Head, SC, pp. 19-22, 1992.
- [42] V. Schoneberg, H.G. Dura, B.J. Hosticka, and W. Mokwa, "Low Drift Gas Sensor with On-Chip Instrumentation," *Proc Intl Conf Solid-State Sensors and Actuators (Transducers '91)*: San Francisco, California, pp. 1006-1007, 1991.

- [43] Marc Madou and S. Roy Morrison, “*Chemical Sensing with Solid State Devices*,” Academic Press: San Diego, CA, Chapters 1,2, 1989.
- [44] Kirshna Persaud and George Dodd, “Analysis of discrimination mechanisms in the mammalian olfactory system using a model nose,” *Nature*, vol. 299, pp. 352-355, September 1982.
- [45] N. Yamazoe and T. Seiyama, “Sensing Mechanism of Oxide Semiconductor Gas Sensors,” *Proc Intl Conf Solid-State Sensors and Actuators (Transducers '85)*: Philadelphia, Pennsylvania, pp. 376-379, 1991.
- [46] F. Winquist, I. Lundstrom and B. Danielson, “Biosensors Based on Ammonia Sensitive MOS Structures,” *IEEE Intl Conf Solid State Sensors and Actuators*, pp. 162-165, 1985.
- [47] J.F. Ross, L. Robins, and B.C. Webb, “The Ammonia Sensitivity of Platinum-Gate MOSFET Devices: Dependence on Gate Electrode Morphology,” *Sensors and Actuators*, vol. 11, pp. 73-90, 1987.
- [48] J.F. Ross, C.I. Terry, and B.C. Webb, “A New Method for Protection against Electrical Overheat Using a Sacrificial Coating and a ChemFET Gas Sensor,” *Journal Phys E Sci Instrum*, vol. 19, pp. 536-539, 1986.
- [49] D. Krey, K. Dobos, and G. Zimmer, “An Integrated CO-Sensitive MOS Transistor,” *Sensors and Actuators*, vol. 3, pp. 169-177, 1982.
- [50] W.J. Bertram, “Yield and Reliability,” in *VLSI Technology*, S.M. Sze ed., McGraw Hill: New York, pp. 612-653, 1988.
- [51] Figaro Engineering (Japan), product specifications and personal communications, 1993-1995.
- [52] N. Yamazoe, Y. Kurokawa, and T. Seiyama, “Catalytic Sensitization of SnO<sub>2</sub> Sensor,” *Proc of the Intl Mtg on Chemical Sensors*, pp. 35-40, 1983.
- [53] G. Heiland and D. Kohl, “Problems and Possibilities of Oxidic and Organic Semiconductor Gas Sensors,” *Proc 3rd Intl Conf. Solid-State Sensors and Actuators, Transducers '85*: Philadelphia, Pennsylvania, pp. 227-233, June 11-14, 1985.
- [54] P.T. Moseley and D.E. Williams, “Oxygen Surface Species on Semiconducting Oxides,” in *Techniques and Mechanisms in Gas Sensing*, P.T. Moseley, J.O.W. Norris, and D.E. Williams, eds, Adam Hilger: Bristol, Chapter 2, 1991.
- [55] Julian W. Gardner and Philip N. Bartlett, “Performance Definition and Standardization of Electronic Noses,” *Intl Conf on Solid State Sensors and Actuators, Transducers '95*: Stockholm, Sweden, pp. 671-674, 1995.
- [56] P.A. Allen and D.R. Holberg, *CMOS Analog Circuit Design*. Saunders College Publishing, Fort Worth, TX, 1987. Chapter 7, pp. 322–364.
- [57] Tonia G. Morris, Denise M. Wilson, and Stephen P. DeWeerth, “Analog VLSI Circuits for Manufacturing Inspection,” *16th Conf on Advanced Research in VLSI*: Chapel Hill, North Carolina, pp. 241-255, 1995.

- [58] J. Lazarro, S. Ryckebusch, M.A. Mahowald, and C.A. Mead, "Winner-Take-All Networks of O(N) Complexity," *Caltech Computer Science Dept Tech Rep, Caltech-CS-TR-21-88*, 1989.
- [59] Dimitrios Vlachos and John Avaritslos, "Fuzzy Neural Networks for Gas Sensing," *Intl Conf on Solid State Sensors and Actuators, Transducers '95*: Stockholm, Sweden, pp. 177-180, 1995.
- [60] J.V. Hatfield, P. Neaves, P.J. Hicks, K. Prsaud, and P. Travers, "Towards an integrated electronic nose using conducting polymer sensors," *Sensors and Actuators B*, vol. 18-19, pp. 221-228, 1994.
- [61] H. Lorenz, M. Pescheke, H. Riess, and I. Eisele, "Recognition of hyrdrogen and ammonia by modified gate metallization of the suspended gate FET," *Sensors and Actuators B*, vol. 1, pp. 21-24, 1990.
- [62] J. Suehle, R. Cavicci, M. Gaitan, and S. Semancik, "Tin oxide gas sensor fabricated using CMOS micro-hotplates and in-situ processing," *IEEE Electron Device Lett*, vol. 14, no. 3, pp. 118-120, 1993.
- [63] O. Tabata, R. Asahi, H. Funabshi, K. Shimaoka, and S. Sugiyama, "Anisotropic etching of silicon in TMAH solutions," *Sensors and Actuators A*, vol. 34, pp. 51-57, 1992.
- [64] Kris Pister, UCLA, MEMs newsgroup bulletin, 1995.
- [65] S. Semancik, R.E. Cavicchi, K.G. Kredier, J.S. Suehle, and P. Chaparala, "Selected-Area Deposition of Multiple Active Films for Conductometric Microsensor Arrays," *Intl Conf on Solid State Sensors and Actuators, Transducers '95*: Stockholm, Sweden, pp. 831-834, 1995.
- [66] Richard J. Reay, Erno H. Klaassen, and Gregory T.A. Kovacs, "Thermally and Electrically Isolated Single Crystal Silicon Structures in CMOS Technology," *IEEE Electron Device Lett*, vol. 15, no. 10, pp. 399-401, October 1994.
- [67] Charles A. Harper, "Materials for Electronic Packaging," in *Handbook of Electronic Packaging*, Charles Harper, ed, McGraw-Hill: New York, pp. 7-1-7-135, 1969.
- [68] David S. Soane and Zoya Martynenko, *Polymers in Microelectronics: Fundamentals and Applications*, Elsevier: Amsterdam, pp. 67-75, 1989.
- [69] R. Smith and S. Collins, "Sensor Design and Packaging," in *Sensors: A Comprehensive Survey*, W.Gopel, J. Hesse, and J.N. Zemel, eds, VCH: Weinheim, Germany, pp. 79-106, 1989.
- [70] R. Frank, M.L. Kniffin, and L.J. Ristic, "Packaging for Sensors," in *Sensor Technology and Devices*, Ljubisa Ristic, ed, Artech House: London, pp. 203-238, 1994.
- [71] R.L. Smith and D.C. Scott, "Integrated Sensor for Electrochemical Measurements," *IEEE Trans on Biomedical Engineering*, BME-33, pp. 83-90, 1986.
- [72] R.L. Smith and S. Collins, "Micromachined Packaging for Chemical Microsensors," *IEEE Trans Elec Devices*, ED-35, pp. 787-792, 1987.