Sensor properties of carbon nanotube/ZnO composites in ammonia presence

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The combination in a single device of nanowire sensors with different electrical properties in the presence of gases is one of the systems of the "electronic nose" on a single chip [1]. However the development of individual semiconductor devices involves technical difficulties in holding identical properties from crystal to crystal. The development of composites from different nanowires with different electrochemical properties is more promising to ensure stability and reproducibility [2]. The properties of a composite consisting of percolate networks based on carbon nanotubes and ZnO nanorods investigated in this work for ammonia vapor sensor production.

In this work we suggest method of nanowire based sensor structures sensitivity improvement. We developed heterogenic composite of carbon nanotubes and semiconductor nanorods. Structure with composite based sensing area was developed. A dependence of sensor resistance and response on ammonia vaporous, composite specific surface on carbon nanotube and ZnO proportion in composite was investigated. The specific surface of CNT/ZnO composite grows from 30 to 300 m^2/g while resistance drops from 80 to 2 kOhm when CNT concentration changes from 40% to 80%. It was shown that sensitivity decrease by an order of magnitude when nanotube concentration changes from 60 to 80%. Moreover the relative response decreases by an half order of magnitude under sensor heating up to 200 °C. This result can be used in “electronic nose” systems development.

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[2] H. Huang, Q. Yu, Y. Ye et al., Cryst.Eng.Comm 14 (2012) 7294-7300