Sensors based on nanomaterials

High-performance humidity sensors based on high-field anodized porous alumina films

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Abstract: Improved humidity sensors based on porous anodized alumina (PAA) films were prepared via stable high-field anodization and subsequent isotropic chemical etching for appropriate times. The results reveal that sensitivity over a wide humidity range can be adjusted by changing the microstructure of the porous alumina layer, which can be explained in terms of the inhomogeneous distribution of anion impurities in the pore sidewall. The short response and recovery times obtained were ascribed to the ordered pore arrays and large pore size of the PAA films. This study has significance in tailoring the moisture sensitivity in the design of diverse sensors for practical applications. © 2009 IOP Publishing Ltd. (29 refs.)

Hydrogen-sensing materials: Fabrication and performance of Pd-Ni alloy nanowire arrays

Yu, Gang[1]; Si, Wei-Wei[1]; Tang, Li-Li[1]; Zhou, Bao-Ping[1]; Qiao, Li-Jie[2] **Source:** *Harbin Gongcheng Daxue Xuebao/Journal of Harbin Engineering University*, v 30, n 3, p 328-331, March 2009 **Language:** Chinese
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Abstract: In order to optimize hydrogen-sensing performance of Pd-Ni alloy nanowire arrays, various Pd-Ni alloy patterns of nanowire arrays were made by various fabrication techniques. Continuous and smooth nanowires were fabricated in an **anodic** aluminum oxide (AAO) template. Nanoparticle chains of Pd-Ni alloy were produced at the step edges of highly oriented pyrolytic graphite. Dendrite or web **porous** nanowires were obtained on Pt microelectrodes by AC electrodeposition. Hydrogen-sensing experiments showed that nanoparticle chains of Pd-Ni alloy and **porous** nanowires have higher susceptivity to hydrogen and respond faster. Therefore, hydrogen **sensors** made of nanoparticle chains or **porous** nanowires will provide excellent performance. (8 refs.)

Platinum nanowire array electrochemical sensor: Fabrication and characterization

Zhong, Fuxin[1, 2]; Zong, Ruilong[1]; Zhu, Yongfa[1] **Source:** *Journal of Nanoscience and Nanotechnology*, v 9, n 4, p 2437-2441, April 2009
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Abstract: Platinum nanowire array sensors were prepared by alternating current electrochemical deposition of platinum into the pores of anodic aluminum oxide template. The nanostructure displayed perfect electrochemical stability with 10 segments of the cyclic voltammetry curves coincided completely, and the oxide-current peak of H2O2 was in the range of 0.3-0.6 V. Moreover, the response current has an excellent linear relationship with the H2O2 concentration at the range from 4.5×10^{-3} mM to 2.3×10^{-1} mM, and the detection limit was about 0.56 μM. After dissolving AAO template in 0.3 M KOH for 20 min, the sensitivity of the sensor was increased from 34.76 μA mM^{-1} mm^{-2} to 62.35 μA mM^{-1} mm^{-2}, and the detection limit was lowered from 0.56 μM to 0.28 μM. Furthermore, the platinum nanowire array sensors presented good stability and repeatability. (29 refs.)

Temperature dependence of a nanoporous Pd film hydrogen sensor based on an AAO template on Si

TasaltIn, Nevin[1]; Oztürk, Sadullah[1]; KIIInç, Necmettin[1]; Ziya Oztürk, Zafer[1] **Source:** *Applied Physics A: Materials Science and Processing*, v 97, n 4, p 745-750, December 2009 **Language:** English
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Abstract: In this study, hydrogen sensing properties of nanoporous Pd films based on Anodic Aluminium Oxide (AAO) templates grown on a silicon substrate have been investigated at various temperatures (25-100°C) and hydrogen concentrations (100-1000 ppm) to determine the temperature-sensitivity relationship. For this purpose, a hexagonally shaped AAO template of approximately 50 nm in diameter and 700 nm in length with 80 nm interpore distances was fabricated using two-step anodization of an Al film deposited on an n-type (100) oriented oxidized Si substrate. Then, the nanoporous surface of the AAO template was used as a substrate for supporting a nanoporous Pd film of an approximately thickness of 60 nm. The morphologies of the AAO template and Pd film coated on the AAO template were studied mainly by Scanning Electron Microscopy (SEM). Hydrogen sensing properties of the nanoporous Pd film were measured using a resistance transient method. It was found that the sensor response of the nanoporous Pd films on the AAO template was better than the traditional Pd thin film sensors, the sensitivity of the sensor was approximately 1.8% for 1000 ppm H2, and the detection limit was lower than 100 ppm at room temperature. The highest sensitivity was measured at room temperature. © 2009 Springer-Verlag. (20 refs.)

Amorphous TiO_2 nanotube arrays for low-temperature oxygen sensors

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Abstract. Titania nanotube arrays (TNTA) were synthesized on a titanium substrate using anodic oxidation in an electrolyte containing ammonium fluoride and evaluated for low-temperature oxygen sensing. Their sensing properties were tested at different temperatures (50, 100, 150, 200, 250 and 300 °C) when exposed to various oxygen concentrations. The as-prepared TNTA are amorphous and exhibit much higher carrier concentration than that of annealed TNTA. Such amorphous TNTA show much higher sensitivity than that of annealed TNTA, $SrTiO_3$ and Ga_2O_3 sensors. This sample demonstrates the lowest detectable oxygen concentration of 200 ppm, excellent recovery and good linear correlation at 100 °C. These results indicate that TNTA are indeed very attractive oxygen-sensing materials.