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EFFECT OF THE MICROSTRUCTURE ON THE NO_x AND HUMIDITY SENSING CHARACTERISTICS OF WO₃ THIN-FILM SENSORS

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The nitrogen oxides (NO_x) gases are very hazardous to the human body and thus the importance of NO_x sensors is rising. The sensitivity of NO_x gas exhausted from automobiles using WO₃ thin films has been affected by ambient humidity. In the present study, the microstructure of WO₃ thin films was controlled by depositing at different substrate temperatures (ambient temperature and 300°C, respectively). The WO₃ thin films with 3000Å thickness were deposited on the alumina substrate by using a high-vacuum resistance heating evaporator and annealed at 500°C in air. Their crystallinity was measured by XRD and the microstructure was observed using SEM. The NO_x gas and humidity sensitivities of the WO₃ thin-film sensors were measured at 200°C in a hermetically sealed box by a current detection method. The results are also discussed.

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STUDY ON SENSING CHARACTERISTICS OF WO₃ THIN FILMS DEPOSITED BY R.F. SPUTTERING FOR NO_x GAS. YOUNG SOO YOON, TAE SONG KIM, JONG HAK JUNG, KWANG SOO YOQ and HYUNG JIN JUNG (Thin Film Technology Research Center, KIST, Seoul 130-650, Korea)

WO₃ thin films were deposited by r.f. sputtering system on polycrystalline Al₂O₃ substrates (unpolished and polished) in order to detect NO_x gas. The as-grown films had various thicknesses, deposition temperatures and annealing temperatures. The as-grown films on the unpolished and polished Al₂O₃ showed higher voltage drop or sensitivity (R_{gas}/R_{air}) at measuring temperature of 200°C and 150°C, respectively than 300°C due to dominant of desorption of NO_x gas at the film surface. The annealing temperature of 600°C for 4hrs made the as-grown film to have highest sensitivity. The as-grown films with the annealing at 600°C on the unpolished Al₂O₃ showed different sensitivity with the deposition temperature. The as-grown films with different film thickness (150, 300, 450 nm) on the polished Al₂O₃ showed almost same sensitivity at the same NO_x concentration. Even though the as-grown WO₃ thin films had high sensitivity, sensing characteristics could be dramatically disturbed by humidity. These results suggested that the WO₃ thin film is very useful for detection of NO_x gas if the disturbance effect of the humidity on the sensing characteristics could be eliminated

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NO_x GAS SENSING CHARACTERISTICS OF WO₃ THICK FILM SENSORS FABRICATED UNDER DIFFERENT SINTERING ATMOSPHERE, YONG K. CHUNG, S. C. CHOI(Dept. of Inorganic Mat. Eng., Hanyang University, Seoul, 133-791, Korea), M. H. KIM, W. S. UM and H. S. LEE(Material Analysis Team, KITECH-KTL, Seoul, 152-053, Korea)

NO_x gas sensing characteristics of WO₃ sensors were investigated. WO₃ sensors were fabricated by thick film technique. paste was coated by screen printing method on the alumina substrate(4×4×0.4mm³) which contained Au electrode and RuO₂ heater on each side and then sensing materials were sintered at 700°C for 1 hr under different atmosphere which were Ar, O₂, and mixture of Ar/O₂. Sensitivity, response time, and recovery time with different sintering conditions were measured at working temperature range from 70 to 300°C. The initial resistance was increased until Ar/O₂ value is up to 1 and decreased slowly over that value (Ar/O₂=1). The NO_x gas sensitivity is increased as Ar/O₂ ratio is adjacent to 1

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Pt-WO₃ MIS CAPACITOR FOR DETECTION OF NO₂ GAS, J. H. LEE, Y. H. LEE, C. K. KIM (Dept. of Electrical and Electronic Engr, Soonchunhyang Univ., Asan, Choongnam 336-745 Korea) K. S. YOQ (Dept. of Materials Science and Engr., University of Seoul, Seoul 130-743, Korea)

Gas sensor utilizing Pt-WO₃ MIS capacitor been explored for NO₂ detection. Pt-WO₃-Si₃N₄-SiO₂- Si-Al capacitor were built on <100> p-type silicon wafers. The silicon wafers were coated with SiO₂ (50 Å) and Si₃N₄ (600 Å) by conventional silicon processing techniques. Then, a WO₃ layer was subsequently grown by deposition of a 1000Å of W, followed by thermal oxidation at 500°C for 1 hour. A detection model based on adsorption/desorption of chemisorbed oxygen ions at the Pt-WO₃ interface is proposed for the sensing mechanism. This report presents data on the devices adsorption characteristics, activation energy, and detection mechanism. The catalytic layer of Pt and adsorptive oxide of WO₃ enhance gas sensitivity.