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Substantial Enhancement of the Response and Sensing Speed of WO_3 Nanotubes Toward NO_2 Gas by Au-functionalization

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Au-functionalized WO_3 nanotubes were synthesized using ZnO nanowire templates. Transmission electron microscopy revealed the Au nanoparticles on the outer surface of a typical WO_3 nanotube ranged from 5 to 25 nm. The multiple networked Au-functionalized WO_3 nanotube sensors showed responses of 820-3, 924% in the NO_2 concentration range of 1-5 ppm at 300°C. These responses were approximately 5-12 fold higher than those observed for pristine WO_3 nanotube sensors over the same NO_2 concentration range. A model describing the gas sensing mechanism of Au-functionalized WO_3 nanotubes is discussed.

Keywords: Nanorods, WO_3 nanotubes, Au functionalization, Gas sensors, Response, NO_2

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Effect of Doping Si in DLC Thin Films Growth on Their Mechanical Properties

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Diamond-like Carbon(DLC) films doping Si were deposited by linear ion source(LIS)-physical vapor deposition method on Si wafer. We have studied the effects of Si content on friction and wear properties of DLC films and the characteristics of the films were investigated using Nano-indentation, Micro raman spectroscopy, Field Emission-Scanning Electron Microscope (FM-SEM) and X-ray Photoelectron Spectroscopy (XPS). The films has been various low-friction and low-stress by varying the flow rates of silane gas. Under the about 2% of Si doping is very suitable for improving the adhesion of films and reducing internal stress while maintaining the surfaces hardness of DLC films. Linear ion source (LIS)를 사용하여 Si wafer위에 Si 이온이 첨가된 DLC 박막을 증착하였다. 참가된Si 이온의 양에 따라 DLC 박막에 미치는 영향을 분석하기 위하여 마찰 계수 및 경도를 비교하였고, Micro raman spectroscopy, Field Emission-Scanning Electron Microscope (FM-SEM) and X-ray Photoelectron Spectroscopy (XPS)를 통하여 표면 상태를 분석하였다. 천체 주입된 가스량의 약 2%까지 Si 이온 주입이 늘어날수록 DLC 박막의 마찰계수는 낮아졌고, 경도는 Si 이온이 주입되지 않았을 경우와 비슷한 값(약 20～23 GPa)을 가졌다. 2% 이상의 주입량에서는 마찰계수는 주입량이 늘어날수록 높아졌으며 경도는 떨어지는 경향을 보였다. 이는 Si이온이 2%이하로 첨가되었을 경우, DLC 박막의 생성시 탄소 이온들의 결합 Stress를 줄여 마찰계수가 줄어든다고 볼 수 있으며, 그 양이 2%이상이 되면 오히려 불순물로 작용하여 DLC 박막의 Stress는 급격히 증가하고 마찰계수도 높아짐을 알 수 있다.

Keywords: DLC, Low-friction, Internal Stress