Highly selective VOCs sensor fabrication via Combinatorial ZnO and Graphene Oxide solution

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The need for highly selective VOCs sensor has been growing as environmental conditions including indoor and atmosphere become worse year by year. Several technologies to detect and recognize different types of VOCs in one environment has been developed but those still have similar issues such as low selectivity or complex module of photoionization detector (PID) and chemiresistor sensors [1,2]. In applications, crop condition in agriculture industry can be identified using VOC sensors. For the indoor air quality improvement, 5 representative VOCs such as formaldehyde, toluene, benzene, ethyl benzene, and xylene are reported to be monitored not to over the inhalation limit, but there is no simple and cheap sensors to monitor indoor air quality in terms of sensitivity and type to decide the ventilation in time[3,4].

In this study, we suggest a new approach to develop a highly selective VOCs sensor by mixing ZnO solution and graphene oxide solution in different ratios. Three different concentrations of graphene oxide aqueous solution were purchased from UniNanoTech, Korea, supplied by GrapheneSupermarket, USA. 6.2 g/L, 5 g/L, and 0.5 g/L of graphene oxide aqueous solution with different weight % of monolayer graphene oxide were utilized. ZnO solution was made by zinc acetate dehydrate and chelating agent 2-methoxyethanol (DEA), (Aldrich, USA) by following the described method in our previous study [5]. By utilizing great electric properties of grapheme oxide, poor selectivity of metal oxide based sensor is thought to be modified to minimize the malfunction of current chemiresistor sensors. In figure 1, surface morphology of ZnO was observed by SEM. Depending on the molar ratio of zinc acetate and dehydrate and DEA. Porosity and preferred crystalline plane of ZnO was controlled. In figure 2, resistance change of spin coated ZnO layer on 25 μm thick platinum bottom electrode on silicon nitrate substrate. Sensing property in terms of sensitivity, selectivity and response time will be discussed using ZnO-graphene oxide mixture in different mixing ratios from 1:1 to 1:10.

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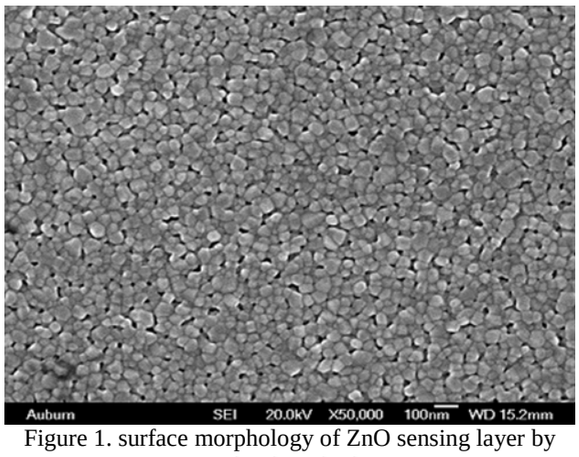

Figure 1. surface morphology of ZnO sensing layer by sol-gel method.

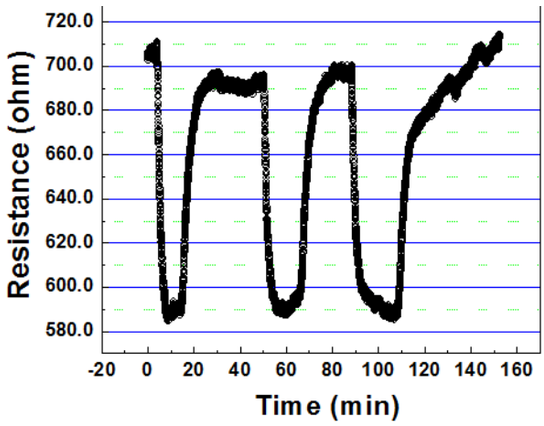

Figure 2. resistance change of ZnO sensing layer under 100ppm of ethanol at 300 ℃