Improvement in performances of Cu-phthalocyanine thin film-based NO2 gas sensor through a control of microstructures

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In order to realize a high-sensitivity, low temperature operable NO2 gas sensor, thin fimls of several metal phtalocyanines(MPc's) have been deposited on glass substrates by the vacuum sublimation method. Effects of central metals on the gas-sensing characteristics of thin films have been investigated. The conductivity and sensitivity of MPc films are closely related to an eletronic structure and an electronegativity of the central metal atoms. Responce characteristics also vary with the MPc thin films. Atomic force microscope(AFM) studies reveal that the response characteristics are influenced greatly by shape and microstructure of the film grains.

Furthermore, we have attempted to improve the gas-sensing characteristics through a modification of the film microstructure. Firstly, a reversibility in cycles of gas doping and dedoping is improved by film deposition on hydrofluoric acid-treated substrate. Secondly, the gas sensitivity is remarkably increased by an insertion of higher-sensitive layer (vanadyl Pc film) between the α-CuPc film and the glass substrate in the low gas concentration range. It is found from AFM analysis that this phenomenon may be closely related to a modification of the film microstructure.

Although further intensive investigations are still necessary, the present study clearly indicates the effects of central metals on the gas-sensing characteristics of phthalocyanine thin films, and possibility of improving the sensing characteristics of the MPc film-based NO2 gas sensors through the structure control.