Nanostructured surfaces

Sensing properties of fullerene-aluminium nanostructured films

I.V. Kruglenko[1], J.V. Burlachenko[1], D.O. Grynko[1]

[1] *V.Lashkaryov Institute of Semiconductor Physics NAS of Ukraine*
Nauki av. 41, 03028, Kiev, Ukraine, deltayulek@mail.ru

Sensing properties of a surface depends of its structural organization. The importance of nanoorganized surfaces for sensor applications is concerned with the dependence of its physical-chemical properties on the characteristic size of a structure elements. The morphology of fullerene and fullerene-based films [1] can be changed in the definite way by creation of mixed metal-fullerene layers and some external influence (for example photopolymerization,). This fact can be used for the creation of sensor arrays with definite selectivity profile determined by different and exactly defined morphology of sensitive layers.

The adsorption properties towards ethanol and water vapours (quartz crystal microbalance, QCM [2]) and their correlation with the morphology of fullerene and fullerene-aluminium films (AFM) are investigated. The photopolymerization of fullerene films by exposure under ultraviolet irradiation is considered as a promising way of modifying of adsorption capacity of the investigated films.

Introduction of the aluminium decreases the typical surface cluster size from 70-100 nm for fullerene film to 20-30 nm for fullerene-aluminium one. At the same time the uniformity of the surface is improved. While sensors with fullerene sensitive layers demonstrate 10-15 Hz response on water and ethanol, the sensitivity of fullerene-aluminium coated sensor is 15-20 times higher. Another type of surface modification is its photopolymerization. Fullerene and fullerene-aluminium films were exposed under constant UV irradiation during different time intervals.

The possibility of sensors sensitivity control by modifying of fullerene sensitive layers is shown. The addition of aluminium to the fullerene sensitive film changes its morphology and consequently improves its adsorption capacity. Both fullerene and fullerene-aluminium films demonstrate the increase of sensitivity to ethanol and water vapours after their exposure under UV irradiation.

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