ELECTRICAL AND SENSORY PROPERTIES OF SILICON – GRAPHENE NANOSYSTEMS

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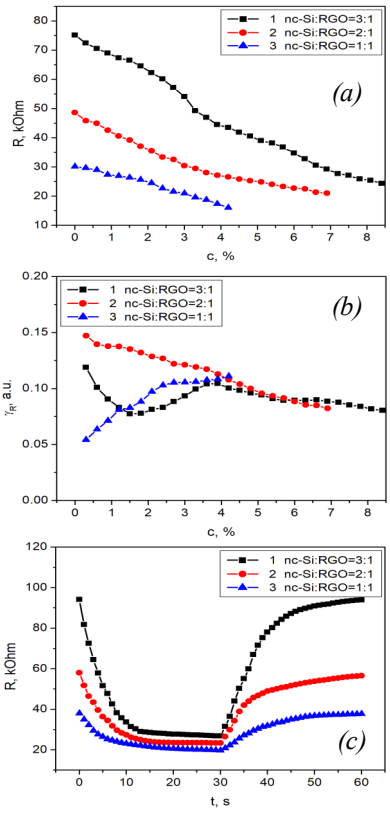
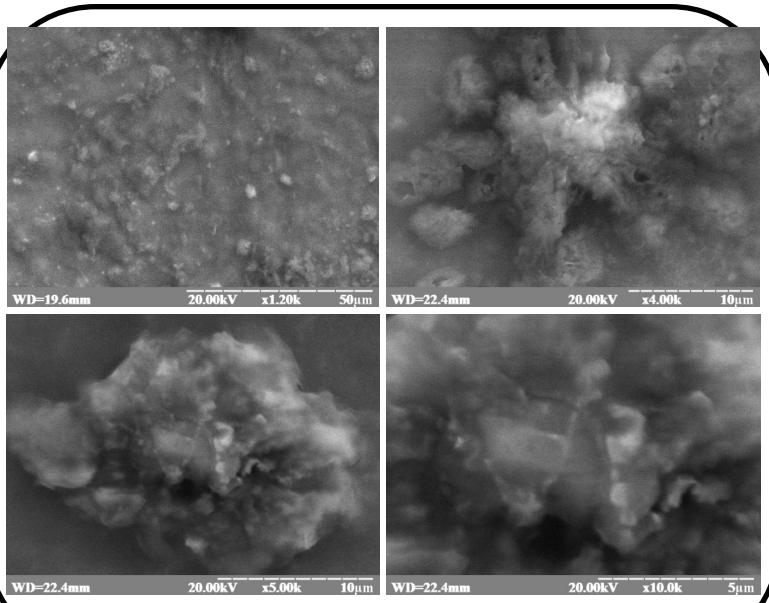
The aim of this work was to study the electrical and gas sensing properties of silicon – graphene nanosystems manufactured by coating silicon nanostructures with reduced graphene oxide. Ultra-high specific surface area of graphene and silicon nanostructures causes high sensitivity of nanomaterials to the adsorption of gas molecules.

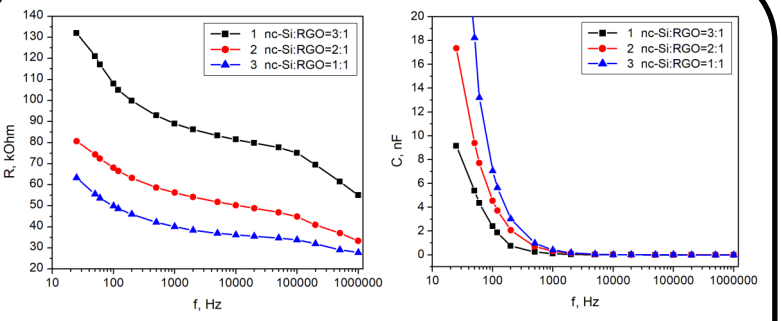
To obtain hybrid nanosystem was used silicon nanocrystals and reduced graphene oxide (RGO). A finely-dispersed powder were obtained by separating the porous silicon layer from the plate surface. A stable suspension of the RGO was prepared by the reduction of the aqueous dispersion of graphene oxide under the action of hydrazine monohydrate. As surfactant, to prevent yielding a precipitation of reduced graphene oxide powder, 0.2 M solution of sodium dodecylbenzenesulfonate in water was used. Suspensions containing a mixture of silicon and graphene nanoparticles with ratio RGO : nc-Si = 1:1; 1:2 and 1:3 were deposited to a prepared surface.



Dependence of resistance (a) and sensitivity (b) of the nc-Si - RGO nanosystems on the concentration of ammonia molecules. Sensor response to the step-like change in the concentration of NH_3 (c).



SEM -images of nc-Si - RGO nanosystems



Frequency dependencies of resistance and electrical capacity of the nc-Si - RGO nanosystems

To estimate the sensory properties of nc-Si - RGO nanosystems the adsorption sensitivity to action of ammonia molecules was determined using equation

$$\gamma_R = \frac{1}{R_0}\frac{\Delta R}{\Delta c}$$

Consequently, the hybrid silicon – graphene nanosystems as working materials for the sensors provide improved performance of the latter. In particular, the response time is about 30 s.