Nanocomposites and nanomaterials

Formation and sensor properties of ZnO nanosystems with capacitive characteristics

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New technologies of highly porous metal layers formation are of great research interest nowadays due to wide range of possible applicat in sensitive elements, biological and gas sensors, catalysts, biocompatible materials, etc. Porous metal systems are typically synthesized u quite complicated multistage de-alloying processes or template techniques. The first method is based on chemical or electrochemical etchir one or more chemical elements from a metal alloy. In the template method, the template with desired pore structure is prepared on the first s After that, the cavities in the template are filled with a metal and the template material is removed.

In connection with this, it is very promising to replace the above-mentioned conventional techniques by new technological approach th based on self-assembly of porous nanosystems under conditions close to thermodynamic equilibrium. Under these conditions, transition fron fluctuation adatoms aggregation into subcritical nuclei to their atom-by-atom embedding into active centers is observed.

Using near-equilibrium condensation conditions, zinc nanosystems have been obtained with three-dimensional grid morphology. In this as shown by TEM and SEM studies, the thickness of interconnected zinc nanowires is less than 100 nm. On the second step, zinc nanosys were oxidized in air at 400 ^{o}C with purpose to obtain ZnO. However, unlike the original morphology of Zn nanosystems, ZnO morphology transformed into system of plates, which remind a system of interconnected capacitors. At the same time, obtained ZnO nanosystems complicated current-voltage characteristics due to capacitors charging and the fact that conductivity of thin gaps connecting the plates is gr determined by the oxygen presence. In the case if they adsorb a significant amount of oxygen, they will get dielectric properties. As a result system capacity and the charge transfer character changes.

Based on sensor properties studies, it has been found that the presence of 0.1% propane-butane mixture in the air atmosphere essent changes the current-voltage characteristics and the character of current on time dependence at a constant voltage. This fact allows to ch approach to the development of sensors having high selectivity.