Silicon-based nanosensors, created with the use of swift heavy ion track technology

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At present an intensive search for the new technologies, which make it possible to lower the dimensions of electronic devices down to the nanometric size range, takes place worldwide. On this concern, an interest to the development of non-traditional technologies of formation of nanomaterials, nanostructures and their arrays, increases. In this way, in this research the so called swift heavy ion track technology is being used, which is connected with formation of narrow trails of radiation damage ("latent ion tracks") as a result of the high-energy ions impact. By means of the dissolution of latent track material by suitable chemical agents (chemical etching), pores of various forms (such as cylindrical, conical or hyperbolic) and dimensions (typically, 10 to 1000 nm), depending on irradiation parameters, etching conditions and substrate type, are formed. The etched ion tracks can be subsequently filled with practically any material, and the embedded matter can be arranged as either massive wires or tubules, or it just can be dispersed discontinuously as small nanoparticles along the track length.

Here, first results of complex and systematic investigations of various sensor properties of MOS-type structures being recently developed, using the above mentioned technology, are reported. These structures, which has got a general name of TEAMS (Tunable Electronic Anisotropic Material on Semiconductors), are based on etched swift heavy ion tracks (pores) in a dielectric layer on a silicon substrate. Investigations of the TEAMS structures has shown that, depending on the preparation recipe, they reveal well-defined sensor properties under the effect of light, humidity, temperature and frequency. In general, as it was defined from electrical-physical measurements, these structures have shown a Schottky-diode-type behavior with some salient features.