

SiO₂/Si based nanostructures with swift heavy ion tracks for applications in spintronics

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The Swift Heavy Ion Track technology have been used for preparation of SiO₂/Si – based nanostructures, for their further use for creation of magnetic-field-sensitive spintronic devices. For this sake the SiO₂/Si wafers have been irradiated with ¹⁹⁷Au²⁶⁺ ions having energy 350 MeV and fluence $5 \times 10^8 \text{cm}^{-2}$ at the “Ion Beam Laboratory” Center of the Hahn-Meitner-Institute, Berlin, Germany [1].

Further, samples of $1 \times 1 \text{cm}^2$ size were cut from the wafers, and the ion tracks (nanopores) with diameters of about 250 nm and height of about 200 nm have been etched by fluoric acid (HF) in the SiO₂ layer. Thereafter Cu and Ni nanoclusters were electrochemically deposited in the nanopores [2] (Fig.1).

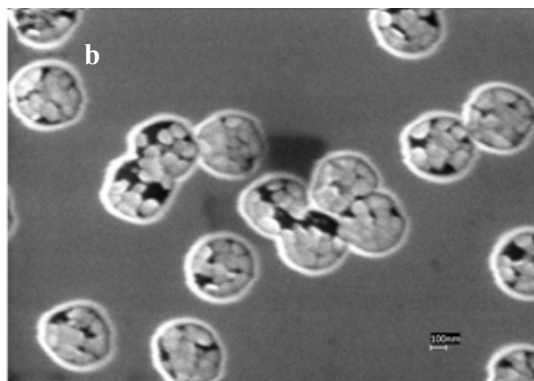
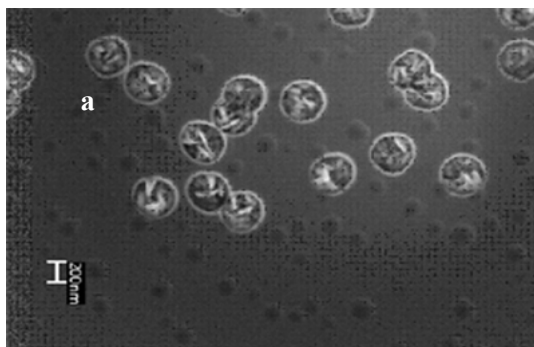


Fig.1: SiO₂/Si structures with Cu (a) and Ni (b) nanoclusters in the etched swift heavy ion tracks in SiO₂ layer.

After the samples preparation, electrical contacting have been carried out, according to the “TEMPOS” (“Tunable Electronic Material with Pores in Oxide of Semiconductors”) concept, which has been developed earlier at the Hahn-Meitner-Institute and the University of Hagen (Germany) [1-3]. In frames of this concept, a sample of the type, which we have prepared, should have three electrical contacts, two of them being on the top of the sample and one of them being on its back side. In that case, we should be getting MOS-type structures, having non-linear I/V characteristics, which is important for the present research. It should be mentioned, that one of the top contacts can serve as a gate for the MOS-structure, which is used during the measurements.

In this way, the complex measurements of current-voltage characteristics of the SiO₂/Si samples with Cu and Ni nanoclusters have been started by our group. The samples with Ni nanoclusters in the nanopores are being studied also in weak magnetic fields up to 0.5 T. As the first measurements results show, the experimental curves are revealing the Schottky diode - type characteristics, which in general, confirm the experimental results obtained earlier on the similar systems [1, 3].

References

- [1] D.Fink, A.Petrov, K.Hoppe, W.Fahrner, R.M.Papaleo, et al, *Nucl. Instr.Meth.* **B218**, 355 (2004)
- [2] D.K.Ivanou, E.A.Streltsov, A.K.Fedotov, A.V.Mazanik, D.Fink, A.Petrov, *Thin Solid Films*, **490**, 154 (2005)
- [3] D.Fink, A.Petrov, W.R.Fahrner, K.Hoppe, et al. *Nucl. Instr.Meth.* **B236**, 11 (2005)

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