Creation of nanoporous SiO_2/Si with precipitated Zn using track technology

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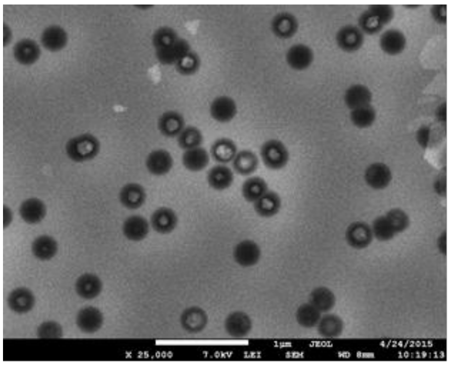
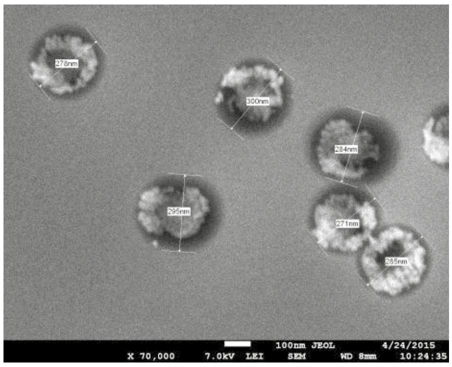
SiO_2/Si structures, produced by thermal oxidizing of silicon substrate. According to ellipsometric data, thickness of oxide layer is 600 nm. Samples were irradiated on accelerator DC-60 (Astana, Kazakhstan) with Xe ions with energy 133 MeV fluence 1×10^9 cm^{-2}.

After etching of ion tracks in 4% water solution of hydrofluoric acid (HF), a precipitation of Zn was performed by chemical and electrochemical methods, at room temperature. Morphology of SiO_2/Si surface before and after precipitation was examined on scanning electronic microscope (SEM) JSM-7500F.



The surface of Si/SiO_2/Zn, (SiO_2 /Si irradiated with Xe 133 MeV, 1×10^9 cm^{-2}), after chemical deposition during 1 min.



The surface of Si/SiO_2/Zn, (SiO_2 /Si irradiated with Xe 200 MeV, 1×10^9 cm^{-2}), after electrochemical deposition during 7 min.

Photoluminescence spectrum of SiO_2/Si(Zn) has a weak peak at 376 nm and sharp peak at 492 nm. For ZnO, the former is related to emissive **exciton** annihilation, and the latter is related to oxygen vacancy. Thus, it is safe to argue that ZnO forms in nanopores during the Zn precipitation process. Luminescence intensity of electrochemically precipitated sample is higher than that of chemically precipitated sample. Annealing in argon atmosphere and in air leads to sudden weakening of glowing of the electrochemically precipitated sample, while the chemically precipitated sample displays little change. Luminescence curve's form in both cases undergoes significant changes after annealing