Supplementary Material (ESI) for Lab on a Chip

Electronic Supplementary Information

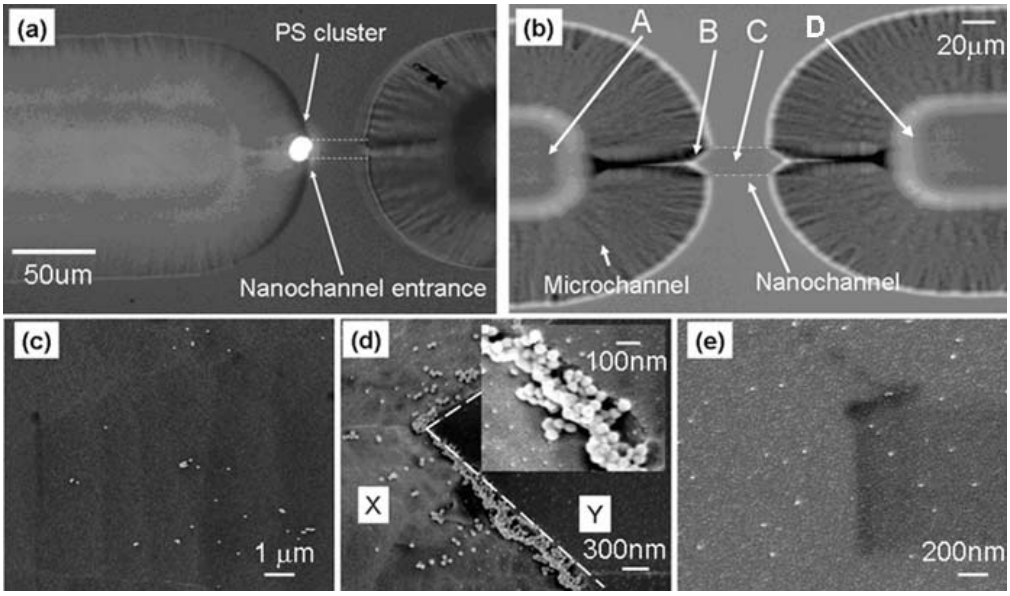

Figure 1. (a) Fluorescent image of polystyrene nanoparticles trapped at the step boundary of the nanodevice (b) optical microscope image of an empty nanofluidic trapping device. (c) (d) (e) SEM images of the nanofluidic trapping device corresponding to the location of A, B and C in Figure 2b after gold nanoparticles were introduced into the device and dried.

Figure 1(b) shows an optical micrograph from the top view of an empty device. Area A and D shows the microchannel. The entrance of the nanochannel region is shown as area B. Area C shows the nanochannel. In our SERS experiment, gold nanoparticles with a diameter of 60 nm (Polysciences Inc, PA) are used as the SERS-active structures. The sample was prepared by blending 20 μM adenine with gold colloids in aqueous solution at a concentration of 2.6×10^{10}/ml with a volume ratio of 1:5. So the ratio of number of adenine molecules to number of gold colloids in the sample is 9×10^{4}:1. After the SERS experiment the channel was dried and the two borosilicate substrates were peeled open into two pieces to investigate the nanoparticle clusters. A scanning electron micrograph (SEM) image around the nanochannel entrance is shown in Figure 1 (d). The small inset is the magnified image of this entrance region. It is obvious that the majority of the gold nanoparticles are aggregated and located at the entrance region along the junction structure. Area X and Y in Figure 2(d) represent the deep and shallow channels respectively, which are shown in Figure 1 (c) and (e). A few isolated gold nanoparticles were found in the deep channel, however, these nanoparticle clusters were very small and scattered. These clusters are also out of the detection area for our Raman microscope system and thus they do not contribute to SERS signal. These SEM images prove that our device is capable of trapping and aggregating nanoparticles at the nanochannel entrance along the junction structure. Some nanoparticles with a diameter smaller than the depth of nanochannel passed through the step, which are shown in Figure 1(e). From the fluorescent and SEM images, it was concluded that majority of the nanoparticles formed clusters specifically at the entrance of nanochannel within the optofluidic device.