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Well defined arrays of silica nanotubes for the study of processes at nanoscale: example of one-dimensional diffusion YAROSLAV KIEVSKY, BRENT CAREY, DANIEL BEN-AVRAHAM, IGOR SOKOLOV, Clarkson University, Potsdam, NY 13699 — Using organic templating synthesis of inorganic precursor, silica, we synthesized well defined fibers of ∼2 microns in diameter and 5 microns in length. Structurally these fibers are parallel arrays of closely packed silica nanotubes (ASNT). BET, SAXS, SEM, TEM, and light scattering techniques were used to characterize these ASNT. Each nanotube is ∼3nm in diameter, and extends to the full length of the fiber, 5 microns. Thus, each array has about a quarter of a million of nanotubes in parallel. We expect these ASNT to be a popular system for the study of processes at nanoscale confined space. Signals from the processes that happen inside each silica nanotube will be amplified by the number of nanotubes, i.e., a few hundred thousand times for each fiber. High monodespersity of the fibers (∼10% standard deviation in the length distribution) allows for amplifying the signals even more. To demonstrate the proposed method, we study diffusion of a dye from a single silica nanotube. Due to the size of the dye molecule, one can treat this process as truly one-dimensional diffusion. Experimental data are compared with a diffusion model. Apart from just pure demonstration, these data show the potential of ASNT in the controlled drug release.

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