Polymer Nanotubules Prepared by the Layer-by-Layer Deposition within AAO Membrane Templates with Pore Diameter Less than 100 nm

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Nanotubules have recently attracted much attention owing to their potential applications in microelectronics, biosensors, and drug delivery systems. It has been regarded as a daunting task to realize polymer nanotubes with diameter less than 200 nm based on the layer-by-layer deposition of polyelectrolytes on the sidewalls of nanoporous templates. When porous substrates with diameter less than 200 nm were immersed in a polymer solution, chained molecules can not easily diffuse into the pores and also can not be readily adsorbed on to the inner pore walls due to the entropic barrier. As a result, the pore mouth is covered and blocked by adsorbing polymers. In present study, in order to overcome such entropic barrier, we controlled the ratio of polymer dimension to pore size by varying either the molecular weight of polymers or the pore size of AAOs, and, at the same time, finely tuned the chain conformation by adjusting solution pH as well as the valency of salts in solution for the uniform deposition of polyelecrolytes on the sidewalls of AAOs. By optimizing these factors, we were finally able to demonstrate well-defined polymeric nanotubules with diameter less than 100 nm.