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Communication

Boron-assisted growth of silica nanowire arrays and silica microflowers for bendable capacitor application

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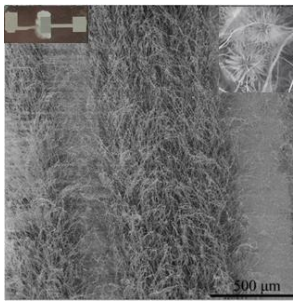
Graphical Abstract



Aligned-long silica nanowire arrays and microflowers were synthesized with boron as catalyst. Besides that parallel plate capacitors were fabricated using the silica nanowire mat as a dielectric. Their frequency response and mechanical properties were investigated.

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ABSTRACT

Aligned silica nanowire arrays and silica microflowers were fabricated using boron as the catalyst and under the flow N_2 gas. The obtained product had no catalyst contamination. And silica nanowires had long lengths of a few hundreds. The growth of nanowire arrays and microflowers was explained using mechanism. Parallel-plate capacitors using silica nanowire mat as the dielectric were fabricated. The silica nanowire capacitor shows a specific capacitance of 0.24 nF/cm^2 at the frequency of 100 Hz. The capacitor is not monotone changing with the frequency. The measurement of mechanical properties show that the tunneling current increases along with an increase in bending angle of the capacitor.

One-dimensional (1D) nanomaterials, such as nanotubes, nanowires (NWs), and nanobelts, have attracted great interest due to their unique physical properties and potential applications in nanoelectronics and nano optoelectronics [1-5]. In the past few decades, many researches have focused on the synthesis and characterization of large quantities of 1D nanostructure. Up to now, nanomaterials with different elements and compounds, such as SiO_x [6-8], CdSe [9], MnO_2 [10], In_2O_3 [11] and Si [12-15], have been successfully synthesized by a variety of methods. Of all nanomaterials, silica nanowires have attracted continual attention because of their excellent properties and their broad application prospects, particularly their blue light photoluminescence and optical application [16-19]. Since Wagner *et al.* first synthesized silica NWs in 1964 with the vapor liquid solid (VLS) growth technique [20], several synthesis methods have been used to synthesize silica NWs including laser ablation [21], chemical vapor deposition (CVD) [22] and solid-state reaction [23] in the existence of different catalysts. However, there are metal contaminations in most synthesis methods. For example, the catalyst keeps on the tip of the nanowires to guide nanowire growth in the VLS mechanism [24]. Therefore, it is crucial to find a method to synthesize aligned and long silica nanowire arrays without metal contamination. Moreover, synthesizing aligned and long

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