Nanoscale Direct Writing by Near-Field Electrospinning Method

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Nanofibers are used as building blocks to enhance the performance of advanced technological devices due to their intriguing physical [1] and chemical properties [2]. Despite numerous nanofiber production methods, the electrospining method [3] is a preferred one due to the continuous production of a wide variety of polymers and high-yield fabrication. In this study, a new type of low-cost nano/micro manufacturing technique, which does not require any advanced facilities or any photo mask as in photolithography technique was implemented. To achieve this, nanofibers were produced by near-field electrospinning technique and written directly on the substrate with an x-y platform. The electrospinning setup includes precisely controlled platform, injector pump, high voltage supplier and a camera. Several parameters were optimized by electrospinning directly on the substrate. The most important factors affecting on the nanofiber patterning are the applied voltage, distance between the needle and the collector, velocity of the stage, concentration of polymer solution and flow rate of the injector. After controlling and optimizing all these variables, the glass substrate was coated by evaporation process and the fibers was directly written on the substrate (Figure 1). The uncovered areas were etched by reactive ion etching. Finally, the nanofibers were stripped off and electrode arrays were obtained. The morphology of electrode arrays was observed by atomic force microscopy and the structure of nanofibers was examined by the scanning electron microscopy.

References

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[3]   L. Dan, Y. Xia, Advanced materials, 14 (2004) 1151.

Figures

Figure 1: Deposition pattern of fibers formed by near-field elecrospinning method