A NOVEL USE OF ELECTROSPINNING FOR NANOPATTERNING OF BIO-SEQUESTERED IRON OXIDE NANOPARTICLES

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Introduction

Nanopatterning is a technique that can produce patterns with nanoscale details on surfaces. It is the fabrication of a nanoscale pattern, especially as a part of an electronic component that is widely used in the semiconductor industry. The patterns obtained play a crucial role in the operation as well as performance of the fabricated electronic, optical or magnetic device and the associated systems. Techniques such as photo and soft lithography's, dip pen nanolithography and nano-imprint technology are presently being used and there are number of ways to combine these strategies. Electrospinning provides a simple and versatile method for generating ultrathin fibers from a rich variety of materials that include polymers, composites, and ceramics.

Methods

Experiment 1

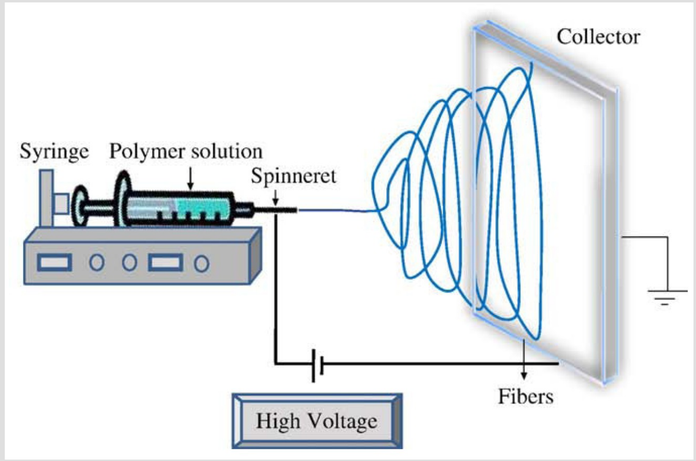
-Firstly bacterial samples(Magnetospirillum magneticum) were isolated and cultured and taken as sample (2ml) for electrospinning.
-This solution was electrospin at a flowrate of 0.25ml/hr, applied voltage of 16V, distance between collector plate and syringe was10cms.
Similarly, every time electrospinning was done by varying the parameters. -This was done in order to set the optimization parameters.
-All the samples were collected and SEM was done.

Experiment 2

-In the next stage electrospinning of Fe2O3 (iron oxide) was done.
-This is done in order to compare both synthetic and magnetotactic bacteria.

- Electropinning at different parameters is being done. The reason behind doing this is that if synthetic iron oxide particles are able to form patterns then the bacteria would also be capable of forming such nanopatterns.
- Characterization of these patterns were done by SEM.

Results



1) Electrospinning process

2) Optical microscopy

Conclusions

In this research on creating controlled nanopatterns, a novel technique using electrospinning of iron oxide nanoparticles is being investigated, where nanopatterns of biologically sequestered magnetite are proposed. This is because electrospinning is normally used in the fabrication of nanofibers governed by the electrical forces on the surface of the precursor organic fluids thereby producing polymer filaments using an electrostatic force. This electrospinning technique can serve various purposes such as the fine control of the fiber diameters, the production of a defect-free or defect-controllable fiber surface, and the formation of continuous single nanofibers. The electrospinning products are currently being used in applications such as fabrication of scaffolds in tissue engineering, substrates for culturing numerous biological cellular structures and various biosensing applications.

Future Directions

The reason is to use this strategy to have consistent nanopatterns via combination of electrospinning parameters.
-Secondly, to compare between synthetic and bacterial iron oxide crystals and their respective patterns via electrospinning as the detection of iron crystals of the bacteria through EDAX in SEM is very challenging due to the size and lesser quantity of the crystals . Hence, we are making use of synthetic iron oxide to first get the patterns via detection through EDAX.

Citations

[1] Isaac Macwan et al, *Int. J. Hi. Spe. Ele. Syst.* **23**, 1450008 (2014) [16 pages] DOI: 10.1142/S0129156414500086
[2] Electrospinning of Nanofibers By Dan Li And Younan Xia;; Advanced materials 2004, 16, no. 14, July19.