

HIERARCHICAL STRUCTURE OF NANOFIBERS BY BUBBFIL SPINNING

by

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Short paper

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A polymer bubble is easy to be broken under a small external force, various different fragments are formed, which can be produced to different morphologies of products including nanofibers and plate-like strip. Polyvinyl-alcohol/honey solution is used in the experiment to show hierarchical structure by the bubbfil spinning.

Key words: *nanofibers, hierarchical structure, morphologies, bubble electrospinning, bubbfil spinning*

Introduction

Bubbfil spinning [1-4] was initiated by Nantong Bubbfil Nanotechnology Company Limited, it is a process that when a polymer bubble under an electrostatic field ruptures, surface minimization of some film fragments might lead to different morphologies of products, including smooth nanofibers, beaded fibers, crimped fibers, nanoparticles, and others, a detailed summary is available in [1]. This paper is to prepare for micro/nano materials with different morphologies using polyvinyl-alcohol (PVA)/honey solution.

Experiment

3.5 g PVA particles (1750±50) and 0.5 g dodecyl benzene sulfonic acid are put into 46 g deionized water to prepare for a 7wt.% PVA solution; 2 g acacia honey is combined with 48 g PVA solution to prepare for a PVA/honey solution. The applied voltage is 20 kV and the distance between the solution surface and the metal receiver is kept at 25 cm.

Result and discussion

Figures 1 to 3 are scanning electron microscopy (SEM) illustrations of the products. Thin and long plate-like strips are observed in fig. 1, which is different from the traditional cylindrical fiber. A large piece of a film fragment might result in a plate-like morphology. Figure 2 shows combined fibers with two stage cascades. A nano/micro moving jet might be

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detached into two or more daughter jets before solidification, and a cascade is formed. Figure 3 shows hierarchical structure of the products, the diameter of cylinder fiber ranges from 170 nm to 3700 nm, different size of film fragments will result in different size of fibers.

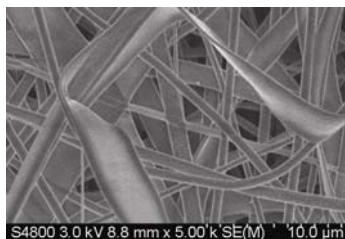


Figure 1. Plate-like strips and cylindrical fibers

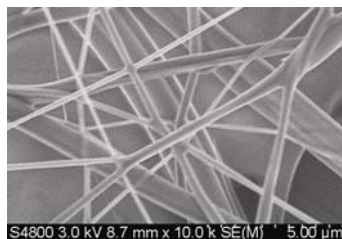


Figure 2. Combined fibers

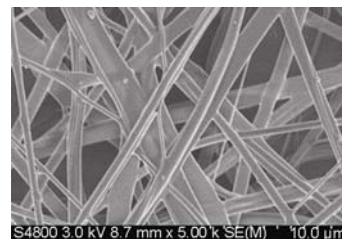


Figure 3. Fibers with hierarchical structure

Conclusion

The paper elucidates that PVA/honey solution is suitable for fabrication of different morphologies of products, ranging from cylinder fibers to plate-like strips and cascade structure. This phenomenon could be explained by surface tension. During the spinning process, surface tension and the wall thickness of a bubble change non-uniformly, this results in different fragments for different morphologies of product.

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