HIGH TEMPERATURE RESISTANT NANOFIBER BY BUBBFIL-SPINNING

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Heat-resisting nanofibers have many potential applications in various industries, and the bubbfil spinning is the best candidate for mass-production of such materials. Polyether sulfone/zirconia solution with a bi-solvent system is used in the experiment. Experimental result reveals that polyether sulfone/zirconia nanofibers have higher resistance to high temperature than pure polyether sulfone fibers, and can be used as high-temperature-resistant filtration materials.

Key words: *high temperature resistant, polyether sulfone/zirconia nano-fiber, bubble-electrospinning, filtration materials*

Introduction

High temperature gas containing dust caused by modern iron and steel industry, power plant and other fields had great harm to the environment and human health. What measures taken would directly decide the influence on the high temperature dust filtering, emission effect of waste heat. Zirconia fiber is an important category of advanced materials for high strength reinforcement and high-temperature insulation in the form of mats, boards, blankets, and so on [1, 2]. Recently composite zirconia fibers became a hot topic in heat-resisting materials [1], and high-temperature-resistant filtration nano-materials have been caught much attention. Though electrospinning is a simple method for producing nano/micro-fibers, its low output limits its industrial applications. This paper applies the bubbfil spinning [3-7], which is the best candidate for mass-production of various nanofibers, for fabrication of heat-resisting polyether sulfone/zirconia nanofibers.

Experimental

Polyether sulfone (PES) solution is used in the present experiment. In order to study the effect of zirconia on the heat-resisting property of the obtained fibers, different concentrations of zirconia nanoparticles are used, all spinning conditions are same except the zirconia concentration.

Figures 1 and 2 are the thermal behavior of the zirconia-polymer fibers in air atmosphere without, and with zirconia nanoparticles, respectively. It is obvious that the thermal

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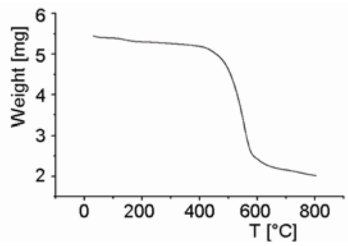

Figure 1. Remaining weight of bubbfil membrane of the PES/PEG

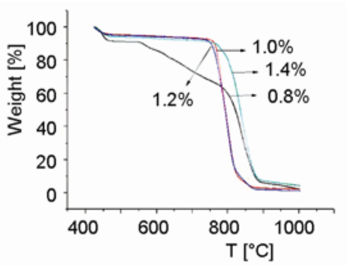

Figure 2. The TG-DTA curve of electrospun PES/PEG with varying ratios of zirconia nanoparticles (0.8 wt.%, 1.0 wt.%, 1.2 wt.%, and 1.4 wt.%)

stability increases from 600 °C to 900 °C. The PES/zirconia nanofibers have higher resistance to the temperature than pure PES fibers.

Conclusions

- Nanofibers with various ratios of zirconia nanoparticles were prepared. Their resistance to high temperature heated improved and PES/zirconia nanofibers have higher resistance to the temperature than pure PES fibers.
- Average diameters increased when zirconia nanoparticles were added; and the sizes began to reduce after heating due to the shrinkage caused by the removal of polymer.
- Multi-scaled porous structure and high surface to volume ratio promoted the application in the high temperature resistant filtration materials. This was attributed to smaller fiber sizes and more smooth pores after PES/PEG nanofiber dissolved in dimethylacetamide (DMAC) containing 1.4 wt.% zirconia nanoparticles heated at 800 °C.

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