STUDY ON THE AIR FLOW FIELD OF THE DRAWING CONDUIT IN THE SPUNBONDING PROCESS

by

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Short paper
DOI: 10.2298/TSCI1504443W

The air flow field of the drawing conduit in the spunbonding process has a great effect on the polymer drawing, the filament diameter and orientation. A numerical simulation of the process is carried out, and the results are compared with the experimental data, showing good accuracy of the numerical prediction. This research lays an important foundation for the optimal design of the drawing conduit in the spunbonding process.

Key words: *spunbonding, air flow field, drawing conduit*

Introduction

The spunbonded non-woven fabrics have been used for medical respirators, protective clothing, geotextiles, *etc.* In the spunbonding process, the polymer melts are attenuated into fine filaments by high velocity air in a drawing conduit. The air flow field of the drawing conduit has a great effect on the filament diameter. In this paper, the air flow field of the drawing conduit in the spunbonding process will be simulated whose results will be compared with the experimental data.

Results and discussions

The Fluent software is employed to simulate the air flow field. The initial air velocity and temperature are 15 m/s, and 20 °C, respectively. Figure 1 is the air velocity vector diagram. The air flows stably when passing through the straight section. With the decrease of the conduit sectional area, the air velocity increases and reaches its maximum in the narrow section. In the expending section, the air velocity decreases with the increase of the conduit sectional area. In the narrow section, the air maintains a quite high velocity along the spinneret axis, which is favorable to the polymer drawing.

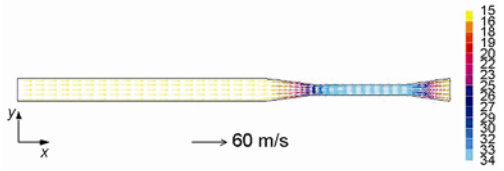

Figure 1. Air velocity vector diagram

To verify the simulated results, a particle image velocimeter is utilized to measure the air velocity in the drawing conduit [1]. Figure 2 shows the simulated and measured re-

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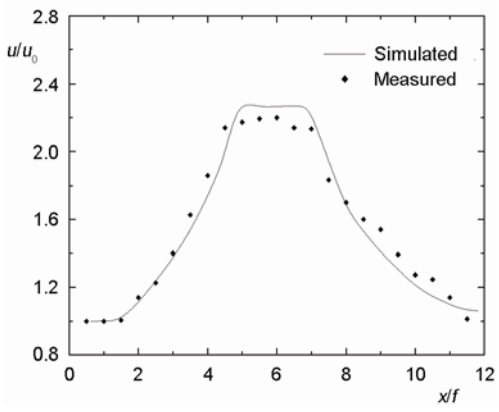

Figure 2. Simulated and measured air velocities

sults. In the figure, u is the air velocity, u_0 – the initial air velocity, and f – the conduit height. It can be seen that the simulated results show good agreement with the experimental data, which confirms the correctness of our simulations of the air flow field.

Conclusions

The air flow field of the drawing conduit in the spunbonding process is simulated numerically. The air velocity is measured with a particle image velocimeter. The simulated results tally well with the experimental data. This research lays an important foundation for the optimal design of the drawing conduit in the spunbonding process.

Acknowledgment

The work is supported by NSFC under Grant No. 51303121, SRFDP under Grant No. 20123201120015, Project for Jiangsu Scientific and Technological Innovation Team (2013) and PAPDJHEI.

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Paper submitted: January 10, 2015
Paper revised: May 5, 2015
Paper accepted: May 12, 2015