EFFECTS OF THE CONDUIT GEOMETRY ON THE AIR FLOW FIELD IN THE SPUNBONDING PROCESS

by

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In the spunbonding process, the air flow field of the drawing conduit affects the polymer drawing and therefore the filament diameter greatly. Effects of the conduit parameters on the air flow field are studied using the previously established air flow field model. The results show that longer narrow section, longer contracting section and larger height of narrow entry are of benefit to increasing the air velocity, thus helpful for decreasing the filament diameter.

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

Introduction

In the spunbonding process, the air flow field of the drawing conduit affects the polymer drawing and therefore the filament diameter greatly. In our previous paper [1], the air flow field of the drawing conduit was simulated and the results coincide with the experimental data. In this paper, effects of the drawing conduit parameters on the air flow field will be investigated based on the model.

Table 1. Main parameters of five drawing conduits

No.	Straight length [mm]	Contracting length [mm]	Narrow length [mm]	Expanding length [mm]	Conduit height [mm]	Entry height [mm]	Exit height [mm]
1	500	0	265	110	50	50	23.3
2	500	100	185	90	50	23.3	23.3
3	400	235	150	90	50	33.3	33.3
4	400	100	275	100	50	33.3	23.3
5	400	150	235	90	50	28.3	23.3

Results and discussions

Air flow fields of five drawing conduits are simulated using the Fluent software. The initial air velocity and temperature are 15 m/s, and 20 °C, respectively. Main parameters of

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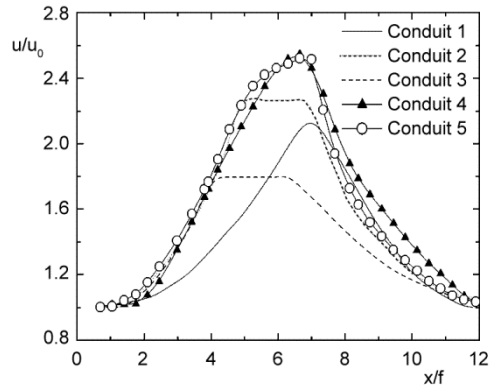

Figure 1. Air velocities in drawing conduits

the five drawing conduits are shown in tab 1. Figure 1 gives the simulated air velocities. In the figure, u is the air velocity, u_0 – the initial air velocity, and f – the conduit height. It can be seen that air velocities in conduits 4 and 5 are larger than those in other three conduits and the maximum velocity is about 2.5 times as large as the initial air velocity, which is helpful for decreasing the filament diameter.

It can be found that longer narrow section can increase the air velocity. For example, the narrow section of conduit 3 is markedly shorter than that of conduits 4 and 5, the air velocity starts to decrease at very low levels, which results in much smaller velocities than those in conduits 4 and 5. The air velocity also increases with the extending of the contracting section. Larger entry height can also yield larger air velocities.

Conclusions

Effects of the conduit parameters on the air flow field are studied using the previously established air flow field model. Results show that longer narrow section, longer contracting section, and larger height of narrow entry can increase the air velocity, thus helpful for the polymer drawing.

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References

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