COMPUTATION AND MEASUREMENT OF AIR TEMPERATURE DISTRIBUTION OF AN INDUSTRIAL MELT BLOWING DIE

by

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Short paper
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The air flow field of the dual slot die on an HDF-6D melt blowing non-woven equipment is computed numerically. A temperature measurement system is built to measure air temperatures. The computation results tally with the measured results proving the correctness of the computation. The results have great valuable significance in the actual melt blowing production.

Key words: *melt blowing, computation, measurement, air temperature*

Introduction

Melt blowing can produce non-wovens of superfine fibers. The temperature distribution of the air flow field of the melt blowing die has great influence on the fiber diameter. Research on the air flow field was performed [1]. But only the air flow field of the laboratory die was measured and simulated, which has limited application values. In this paper, the air temperature distribution of an industrial dual slot die on an HDF-6D melt blowing equipment is computed and measured.

Computation of the air temperature distribution

The dual slot die parameters of the HDF-6D melt blowing non-woven equipment are: the slot width 1.43 mm, the head width 0.5 mm, the slot angle 60°, the inset distance 2 mm, the opening width 1.5 mm and the die length 25 cm. The size of this computation area is 200 mm × 30 mm.

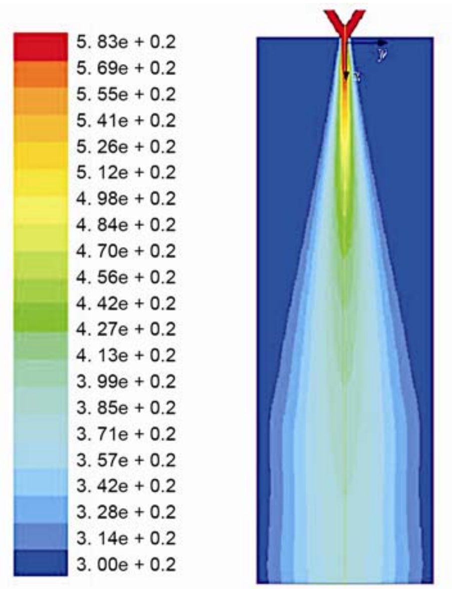

Figure 1. Temperature contours

The computational fluent dynamics software FLUENT is used to compute the air flow field. The inlet velocity is 200 m/s.

The inlet air temperature is 583 K. The outlet air pressure is 1 atm.

Figure 1 shows the computed temperature distribution. It can be seen that the air temperature decreases gradually along the symmetry axis. The highest air temperature always

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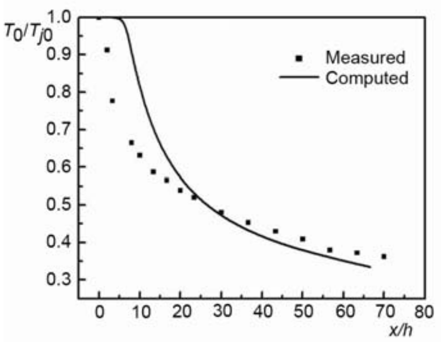

Figure 2. Temperature on *x*-axis

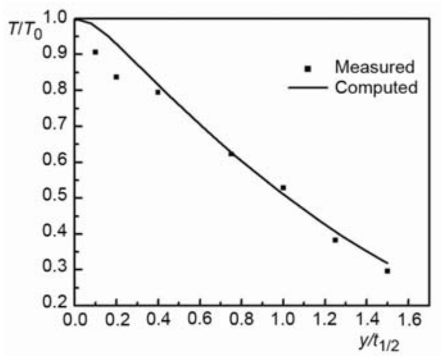

Figure 3. Temperature at *x* = 10 cm

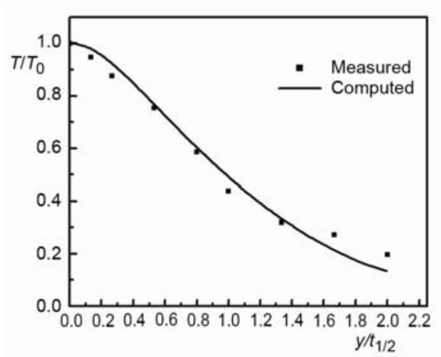

Figure 4. Temperature at *x* = 15 cm

occurs at the symmetry axis on each cross-section, which is quite favorable for the polymer drawing.

Measurement of the air temperature distribution

The temperature measurement system consists of four *K*-thermocouples, a NI9211 data acquisition card and a computer. The measuring errors of Probe 1 to Probe 4 are 2.30%, 1.80%, 1.40%, and 3.09%, respectively, which indicates that the measurement system is applicable in this research.

Results and discussions

The air temperature distribution on the x-axis and the cross-section of x = 10 cm and x = 15 cm are shown in figs. 2-4, respectively. It can be found that the computation results coincide with the measured data, which proves the correctness of the computation. T_0 is the air temperature on the symmetry axis and T_{j0} – the inlet temperature. As can be seen, air temperature decays along the symmetry axis. T is the temperature, and $t_{1/2}$ – the position along y-axis where temperature drops to half of its maximum. Where the further away from the symmetry axis, the lower the air temperature is.

Conclusions

The air flow field of the dual slot die on an HDF-6D melt blowing non-woven equipment is computed numerically. A temperature measurement system is built to measure the air temperatures. The computation results tally with the measured results, which proves the correctness of the computation. The results have great valuable significance in the actual melt blowing production.

Acknowledgments

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Reference

[1] Chen, T., Huang, X., Numerical Simulation of the Air Jet Flow Field in the Melt Blowing Process, *Journal of Donghua University*, *19* (2002), 4, pp. 1-3

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