필터 차압 성능의 주요 인자

왕신펑, 김기태, 김주용
숭실대학교 유기 신소재 · 파이버공학과

The Key Factors of Filtration Pressure Drop

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1. Introduction

Many previous researches [1, 5] indicated that porosity, thickness and fiber diameter are the key factors of filtration pressure drop. According to our research, it should be flow rate, specific surface area and flow path that are the key factors.

2. Simulation

In this paper, we made the media by Gambit and then calculated the pressure and viscous force on the walls by Fluent 6.2. The total force (Including pressure and viscous force) divided by the surface area, we got the average pressure drop. In the following simulation we set the mass flow rate as 1Kg/m^2*s. The average air flow rate is about 0.2040816 m/s.

3. Results and discussion

3.1 The effect of pressure force and viscous force on the filtration pressure drop

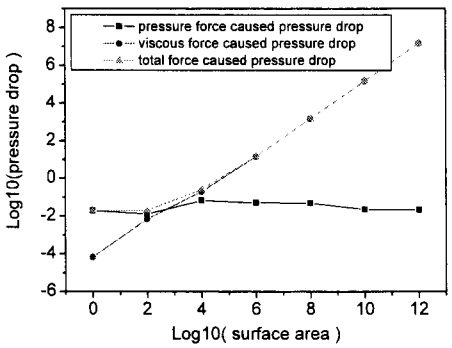
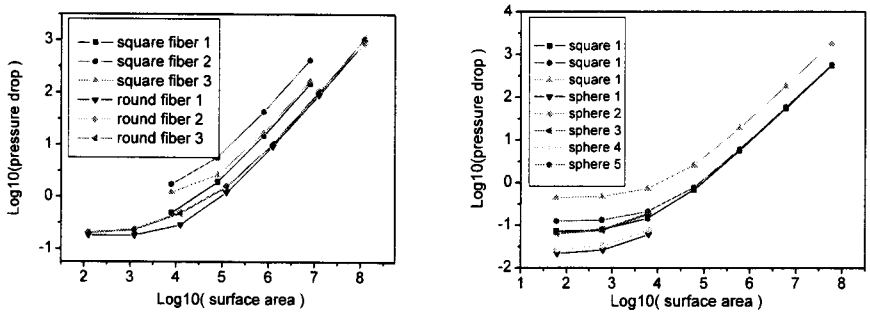


Figure 1 The effect of pressure force and viscous force on the filtration pressure drop

Figure 1 shows the effect of pressure force and viscous force on the filtration pressure drop. We found that when the fiber diameters are not thinner than 1mm pressure force is much higher than viscous force, however when the fiber diameters are thinner than 1mm viscous force is higher than pressure force. That is why log10(viscous force caused pressure drop) shows linear relationship with log10(total surface area) while the log10(total pressure drop) is not.

3.2 The influence of flow path on the filtration pressure drop

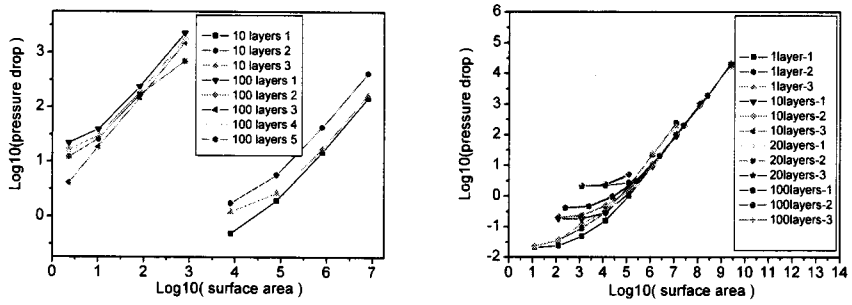
Figure 2 shows the influence of flow path on the filtration pressure drop of different shapes of particles, such as square fiber, round fiber, square and sphere. From the results we can know that square fiber caused pressure drop is 2 or 3 time higher than round fiber, so it is with square and sphere.



(a) square fiber (b) square and sphere

Figure 2 The influence of flow path on the filtration pressure drop

3.3 The influence of filter layers on the filtration pressure drop



(a) square fiber (b) round fiber

Figure 3 The influence of filter layerson the filtration pressure drop

Figure 3 shows the influence of filter layers on the filtration pressure drop. We can know that when we increased the layers, pressure drop will increase linear with layers. And the pressure drop caused by square fiber is increased fast than that of round fiber.

4. Conclusion

According to our research, it should be flow rate, specific surface area and flow path that are the key factors. And when the fiber diameters are not thinner than 1mm pressure force is much higher than viscous force, however when the fiber diameters are thinner than 1mm viscous force is higher than pressure force. That is why log10(viscous force caused pressure drop) shows linear relationship with log10(total surface area) while the log10(total pressure drop) is not. And square fiber caused pressure drop is 2 or 3 time higher than round fiber, so it is with square and sphere.

References

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