Preparation of Titanium Microfiltration Membrane by Field–flow Fractionation Deposition

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Abstract

The primary aim pursued by the preparation of separation membrane is the preparation of the membrane thin as well as with no defect. The field-flow fractionation deposition is a new molding technology which can overcome the traditional disadvantages such as multi-preparation to the preparation of great area of separation membrane with no defect. Therefor the mainly ingredients which influence the appearance and performance of titanium membrane layer are investigated by scanning electricity mirror (SEM) as well as porous material testing instrument: powder performance prepared and confected; selection of supporting body; sintering system such as temperature and time. It is shown that the membrane thickness can be controlled at 50μm or so; the filtration precision mainly rests with powder performance and selection of supporting body and little sintering system

Keywords : titanium membrane, field-flow fractionation deposition, microfiltration

1. Introduction

The membrane separation technology receives the enormous attention from various countries' government and many professions because of its low temperature operation with no changes; low energy consumption, high efficiency as well as few lose of active constituent in materials and so on, and become one of the most successful high technologies in present [1-3]. Although the organic membrane and the ceramic membrane tends to be mature after passing through several dozens of years of development and consummation, these two kind of membranes have many limits separately in the use process. But the metallic membrane may overcome many shortcomings above [4-6] and have synthesis operational performances. Therefore it becomes an essential target which the membrane separation preparation pursues. This article, from its primary factors, discussed the preparation of titanium membrane by field-flow fractionation deposition.

2 Experimental Procedures

2.1 Experimental material and method

The experiment used superfine titanium powder T1, titanium powder T2 processed by the high energy ball milling, and titanium powder T3 after fractionation, to prepare suspending liquid. The substrate used T5, T6 specification of porous tube, with its ventilation performance of 80 $m^3/(m^2.H.KPa)$ and 40 $m^3/(m^2.H.KPa)$ respectively. Metal separation membranes were prepared by the homemade deposition equipment of field-flow fractionation deposition. Prepared tubes used the drying oven to carry on drying processing, used the vacuum furnace to sinter with temperature 850℃ and 900℃, with time 0.5h and 1h.

2.2 Experimental test analysis

In the experiment, samples test was in three positions of prepared tube, the result averaging the three values. The experiment tests as follows: use SKC-2000 light-mitting apparatus to analysis granularity distribution; Use the JSM-8460 scanning electron microscope to observe powder appearance and surface as well as cross section appearance of separation membrane; Use the FBP-3I porous material instrument to test the relative ventilation coefficient of membrane tubes.

3. Results and Discussion

3.1 the influence of Substrate tube on performance

The influence of substrate tube on the titanium membrane mainly manifest in the ventilation performance, shown in 1

Table 1. Specimen preparation parameter and performance

sample	powder	temperature	time	ventilation
1	T1	850	1	60(T5) 39(T6)
2	T2	850	0.5	13(T5)
3	T2	850	1	12.2(T5)
4	T2	900	0.5	12(T5)
5	T2	900	1	11.7(T5)
6	T3	900	1	/

test specimen in table 1. The ventilation performance of the test specimens used by substrate tube T5 is bigger than ones used by substrate tube T6, which is mainly because substrate tube T5 is bigger than substrate tube T6 in the ventilation performance.

3.2 The analysis of membrane fracture appearance

The thickness of titanium membrane prepared is approximately 50μm and 200μm; their fracture appearance are shown in Fig. 1. According to ventilation performance data of sample 3 and 5 in table 1, it is obvious that using the similar substrate tube, membrane level thickness take little influence in the ventilation performance of titanium membrane.

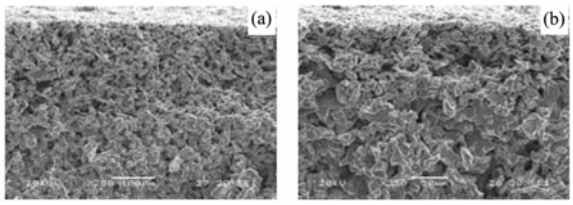
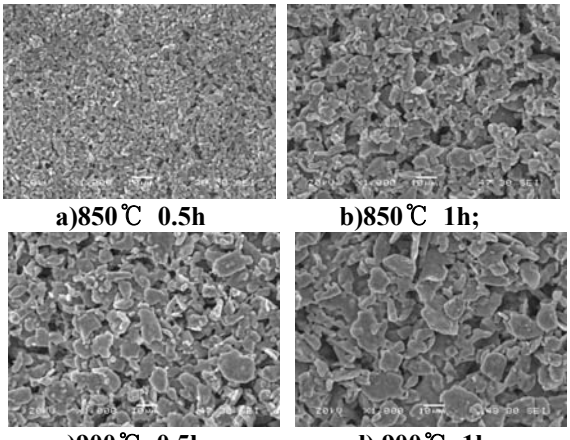


Fig. 1. the fracture appearance of membrane a) sample 3; b) sample 5

3.3 The influence of sintering system

The influence of different sintering systems in the superficial appearance of titanium membrane is shown in Fig.2. It is obvious that temperature and time take the big influence in surface appearance. With the increase of temperature, powders grow up, and massive small pores seal; But along with the increase of time, when temperature is slightly low, the phenomenon above is not obvious, when the temperature is relatively high, the phenomenon above intensifies and bigger powders with level laminate product. But by table 1 obviously, although temperature and time can affect the membrane appearance, they have the small influence in the ventilation performance of titanium membrane.



a)850℃ 0.5h **b)850℃ 1h;**

c)900℃ 0.5h **d) 900℃ 1h**

Fig. 2. the surface appearance of titanium membrane under different sintering system.

4. Conclusion

1) The ventilation performance of membrane mainly receives the influence of subtract tube choose. After tube is desided, other factors have small effect to its performance. The sintering system mainly affect membrane surface appearance;

2) Membrane thickness may be controlled according to need, even easy controlled to about 50μm;

3) By fractionation process, the performance of powder can be adjusted, thus improving membrane performance, and preparing membrane with smaller and evener pore**.**

5. References

[1] Meng Guanyaoet al [J].Nature,1996,18(3):151.

[2] Xu Nanping [J]. Chemical Industry and Engineering Progress,2000,(4):5-9.

[3] Y.S.Lin. Microporous and dense inorganic membranes: current status and prospective[J]. Separation and Purification Technology 25 (2001) 39-55.

[4] Peter N, Rainer R, Andreas K. Metallic Membranes[J]. Filtration & Separation, 1998, Jan/Feb:40-42.

[5] Wen Mingqin [J]. Materials Review, 2002,16(1): 25-27.

[6] Hao Tong [J]. Membrane Science and Technology, 1998,18(6):25-27.

[7] H.P.Buchkremer, M.Bram, P.Neumann. Processing and Characterization of New Porous Materials, IOS Press, 2001.