

The Phase Separation Phenomena of PSf/NMP Solutions in Varying Relative Humidities

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Introduction

Generally, two different techniques have been employed for the precipitation of membranes from a polymer casting solution. In the first method, a precipitant is introduced from a vapor phase. In this case the precipitation rate is very slow and a more or less symmetric structure is formed. In the second method, a precipitant is added to a casting solution by immersing the cast polymer film in a nonsolvent bath. In this case the precipitation rate is very fast and a skinned asymmetric membrane structure is obtained. In this study, we introduced water-vapor to PSf/NMP solution and took photographs of phase separation phenomena of polymer lean phase.

Experimental

PSf/NMP solutions were prepared by dissolving polysulfone in N-methyl pyrrolidone from 15 to 30wt%. The membranes were prepared in the humidity-controlled chamber in a fixed relative humidity at 20 °C for 3hrs. The phase separation behavior of polymer lean phase was observed by an optical microscope.

Results and Discussion

At any polymer contents, the lower the humidity is, the larger the pore size is. At 15wt% of polymer solution, the pore size increases with decreasing relative humidity at 20 °C as shown in Fig. 1. The reason seems that lower humidity enable pores to increase sufficiently. In phase separation, the coarsening effect seems to be a major factor of pore size determination as shown in Fig. 2 of optical microscope photographs.

References

1. H. Strathmann, K. Kock, *Desalination*, 21.241(1977)
2. A.Goetz, U.S. Patent, 2,926,104, (1960)

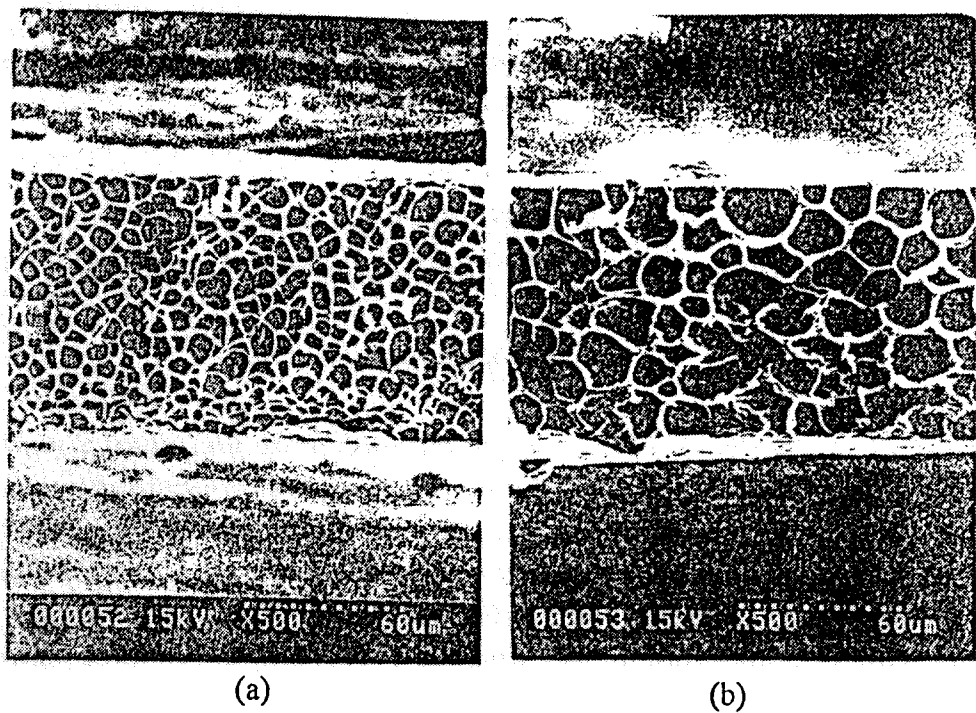


Fig. 1. SEM Photographs of Cross-Section of 15wt% PSf/NMP Membrane by Vapor-induced Precipitation: (a) 100% RH; (b) 70% RH

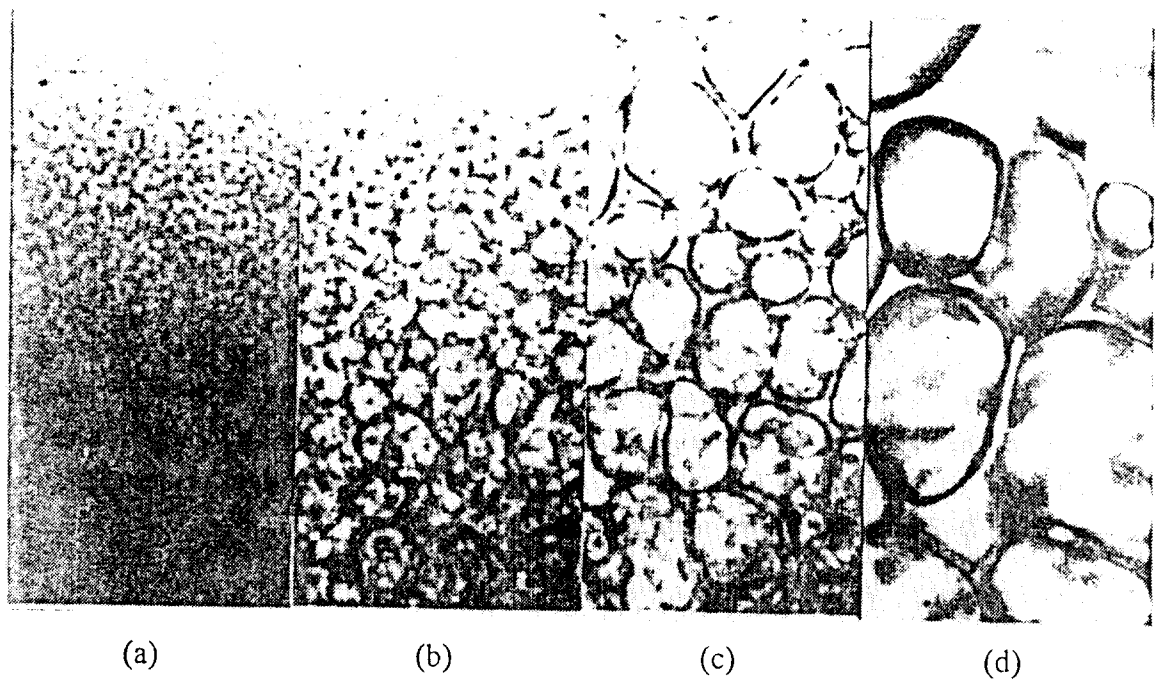


Fig. 2. Optical Microscope Photographs (X 750) of 15wt% PSf/NMP Solution in 70% RH:

(a) 33 seconds after casting; (b) 3 min.; (c) 6 min.; (d) 80 min.