§5. Study on Tritium Removal for LHD with High Polymer Membrane Dehumidification Device

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1. Introduction

In DD experiments for LHD, it is important to establish the removal technique of tritium produced in the vacuum vessel by the DD reaction. In this study, the acquirement of dehumidify characteristics for a membrane type dehumidifier was done and theoretical studies were applied for achievement of high performance dehumidify compared to molecular sieve method..

2. Complete mixing flow model and counter-flow model

It is thought that the combination models of counter-flow and cross-flow are ideal in simulation of gas separation by high polymer membrane, although inherent membrane parameters are required. The two-element mixed gas model in complete mixing flow model doesn't use the membrane-peculiar parameter as shown in Fig. 1. On the other hands, it has been reported that counter-flow model shows good reproducibility for gas separation. In the counter-flow model, the direction of gas flow in supply side is reverse in permeation side, as shown in Fig. 2.

3. Results and Discussion

Simulation using the completely mixing flow model did not clearly show the experimental results about steam separation, although it was a good agreement with that for gas separation in LHD. Therefore, the simulation of steam separation using the counter-flow model has been performed, and it was found that the results of simulation reproduced that of steam separation experiment. The gas separation and steam separation could be reproduced by the completely mixing flow and counter-flow models, respectively. It was thought that this difference was due to the difference of permeation mechanism between gas and steam. It was suggested that this permeation was caused by driving force contributed to partial pressure in gas and molecule diffusion and adsorption force on membrane surface, respectively. It was also indicated from the simulation with changing separation factor that recovery rate increased with increasing of separation factor, as shown in Fig. 3.

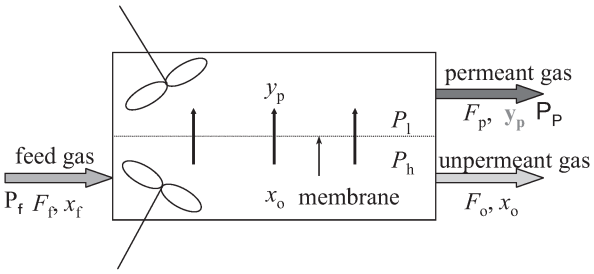

Fig. 1 Schematic view of membrane module in completely mixing flow model

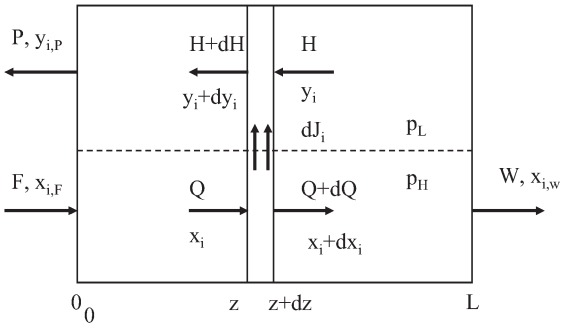

Fig. 2 Schematic view of membrane module in counter-flow model

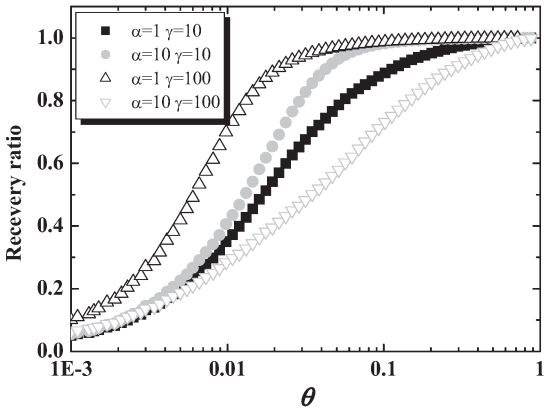

Fig. 3 Simulation results of counter-flow model as a function of separation coefficient