Abstracts

Preparation of macroporous hydrophobic flat-sheet PVDF membranes via vapor induced phase separation

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The aim of this work is to prepare hydrophobic and highly porous polyvinylidene difluoride (PVDF) membranes with high porosity and tunable and narrow barrier pore size distribution in the range from ~0.1 to ~1 µm using the vapor induced phase separation (VIPS) technique.

Polymeric membranes can also be obtained via other phase separation methods, such as non solvent induced phase separation (NIPS) or thermal induced phase separation (TIPS). In contrast to the latter ones the here used VIPS method is not widely used in industrial scale. During the process the cast film of the membrane polymer solution is exposed to humid air prior to immersion in the coagulation bath. It promises interesting ways for influencing important membrane characteristics. Factors like relative humidity, exposure time to humid air or airflow velocity influencing mass transfer can be used for tuning VIPS conditions, so that a macroporous membrane with high porosity, isotropic cross section and narrow barrier pore size distribution can be achieved.

So far, membranes with several of the desired properties have already been prepared in lab-scale. Dependencies of porosity and pore size of the above mentioned parameters have been evaluated. Interestingly, the temperature at which the polymer is dissolved plays a more important role in the VIPS process than in the traditional NIPS process. It has been found that after higher dissolution temperatures a so called nodular structure is formed, which leads to problems in the membrane forming process during the final immersion in the non-solvent.

As a perspective, it will be interesting to explore to what degree it is possible to tune all desired characteristics of the membranes by the VIPS process parameters. Additionally, membranes which can withstand plasma post-treatment for increasing the hydrophobicity are of interest.