INFLUENCE OF VAPOR INDUCED PHASE SEPARATION PARAMETERS ON PVDF MEMBRANE PROPERTIES

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Abstract: In gas/liquid membrane contactors with aqueous solutions, porous hydrophobic membranes are required; typically polypropylene, polyvinylidene fluoride (PVDF) or polytetrafluoroethylene (PTFE) are used. For many emerging applications, contactor membranes should be similar to those used in membrane distillation. Such membranes should be highly porous and as thin as possible to enhance vapor transport, exhibit low heat conductivity to minimize heat loss, be hydrophobic and have proper pore size for anti-wetting properties [1, 2]. Generally, PTFE membranes show higher hydrophobicity than PVDF membranes. However, considering the difficulty involved in processing PTFE, PVDF is the more promising membrane polymer for scale-up [1].

Vapor Induced Phase Separation (VIPS) is a promising method for obtaining highly porous membranes. In VIPS, phase separation is induced by the dilution of the solvent in the polymer solution with the non-solvent (typically water) taken up from the vapor phase. In this work, the influence of VIPS parameters, such as time of exposure or relative humidity, on membrane formation was investigated in detail. Also influences of polymer concentration and dissolution temperature on membrane morphology and structure were investigated. In order to fully characterize obtained membranes, measurements of morphology by SEM, crystallinity by IR, thickness, porosity, pore size distribution, liquid entry pressure, contact angle and gas permeability were performed. With help of the VIPS method, it was possible to obtain membranes which were hydrophobic and highly porous with sponge-like structure. Such membranes could be tailored to have mean flow pore diameters in the range of 0.1 to 0.3 µm. VIPS had the biggest influence on membrane properties when time of exposure was changed; relative humidity had the biggest influence on membrane porosity and thickness. The obtained membranes already fulfill crucial requirements for some new membrane contactor applications.

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References

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