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Procedia Engineering 44 (2012) 316 – 317

Procedia Engineering

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Euromembrane Conference 2012

[OB50] Structured membranes

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Introduction

Most theoretical descriptions of membrane processes rely on homogeneous membrane characteristics, i.e. the permeability is constant along the membrane. Here, we present the fabrication, characterization, and operation of structured membranes. The structures present in these membranes induce inhomogeneous transport along the membrane surface. The inhomogeneity can, in turn, result in secondary transport processes.

Methods

Membranes with controlled geometrical surfaces, e.g. corrugations, can be fabricated in sheet as well as fiber geometry. The methods rely on regular phase inversion methods, now performed in the presence of a confining mold. The resulting membrane replicates the structure of the mold, successfully down to the micrometer lengthscale if the mold stays in contact with the polymer solution during phase separation. Alternatively, during a fiber spinning process, the confining mold can be placed in the spinneret (Figure 1). This leaves a certain delay time for the shaped fluid to return to its more stable, unstructured, state. When coagulation can be performed rapid enough, more of the imposed structure will be present in the resulting fiber.

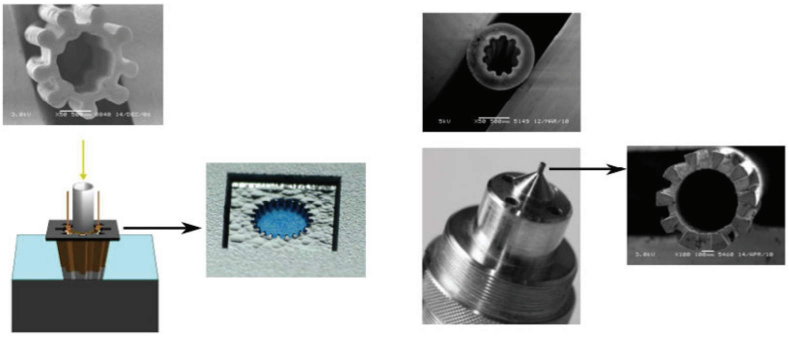

Figure 1. Structured hollow fibers prepared by spinning with a structured spinneret. Both outside or inside structuring can be realized.

The characteristics of the structured porous structured membranes can be tuned accordingly, by varying process parameters like polymer concentration, coagulation bath composition, additives, and temperature. The method offers the possibility to further control the surface

doi:10.1016/j.proeng.2012.08.400

geometry. Corrugations on the surface of a membrane have therefore been studied with relation to transport phenomena.

Results and discussion

The presentation will focus on fabrication characteristics of structured membranes, with emphasis on shrinkage effects, skin properties, and obtainable dimensions. Subsequently, the filtration performance of structured fibers will be analyzed with respect to colloidal filtration of model suspensions. A direct interaction between surface flux, colloidal concentration and diffusion, gives rise to specific deposition patterns on structured surfaces.

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Keywords: microstructuring, spinning, ultrafiltration