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www.elsevier.com/locate/memsci

PII: S0376-7388(17)32636-4
DOI: https://doi.org/10.1016/j.memsci.2018.04.038
Reference: MEMSCI16122

To appear in: *Journal of Membrane Science*

Received date: 13 September 2017
Revised date: 11 April 2018
Accepted date: 24 April 2018

Cite this article as: Phuoc H.H. Duong, Dalaver H. Anjum, Klaus-Viktor Peinemann and Suzana P. Nunes, Thin porphyrin composite membranes with enhanced organic solvent transport, *Journal of Membrane Science,* https://doi.org/10.1016/j.memsci.2018.04.038

Thin porphyrin composite membranes with enhanced organic solvent transport

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Abstract

Extending the stability of polymeric membranes in organic solvents is important for applications in chemical and pharmaceutical industry. Thin-film composite membranes with enhanced solvent permeance are proposed, using porphyrin as a building block. Hybrid polyamide films are formed by interfacial polymerization of 5,10,15,20-(tetra-4-aminophenyl)porphyrin/m-phenylene diamine (MPD) mixtures with trimesoyl chloride. Porphyrin is a non-planar molecule, containing a heterocyclic tetrapyrrole unit. Its incorporation into a polyamide film leads to higher free volume than that of a standard polyamide film. Polyamide films derived from porphyrin and MPD amines with a fixed total amine concentration of 1 wt% and various porphyrin/MPD ratios were fabricated and characterized. The porphyrin/MPD polyamide film was complexed with Cu(II), due to the binding capacity of porphyrin to metal ions. By coupling scanning transmission electron microscopy (STEM) with electron energy-loss spectroscopy (EELS), Cu mapping was obtained, revealing the distribution of porphyrin in the interfacial polymerized layer. By using porphyrin as amine-functionalized monomer a membrane with thin selective