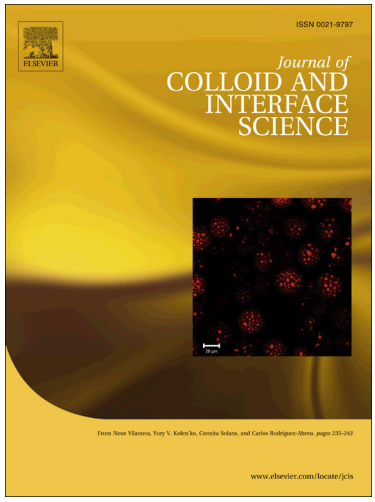

Mixed-matrix membranes incorporated with porous shape-persistent organic cages for gas separation

Hongchao Mao, Suobo Zhang

PII: S0021-9797(16)30900-6
DOI: http://dx.doi.org/10.1016/j.jcis.2016.11.023
Reference: YJCIS 21751

To appear in: *Journal of Colloid and Interface Science*

Received Date: 30 August 2016
Revised Date: 2 November 2016
Accepted Date: 7 November 2016

Please cite this article as: H. Mao, S. Zhang, Mixed-matrix membranes incorporated with porous shape-persistent organic cages for gas separation, *Journal of Colloid and Interface Science* (2016), doi: http://dx.doi.org/10.1016/j.jcis.2016.11.023

Mixed-matrix membranes incorporated with porous shape-persistent organic cages for gas separation

Hongchao Mao, [a] Suobo Zhang [a]*

[a] Key Laboratory of Polymer Ecomaterials, Changchun Institute of Applied Chemistry, Chinese Academy of Sciences, Changchun 130022, China.

** Corresponding author. Fax: +86 431 85262117; E-mail: sbzhang@ciac.jl.cn .*

Abstract

There has been much recent interest in the use of porous materials derived from self-assembling, shape-persistent organic cages due to their solubility and easy post-synthetic modification. Herein we report the preparation of novel mixed-matrix membranes (MMMs) employing the porous organic cage Noria and its derivatives Noria-Boc and Noria-CO^{t}Bu as the fillers, and a fluorine containing polyimide, 6FDA-DAM, as the polymeric matrix. The physical structures and properties of Noria and its derivatives were measured and investigated. Noria with substituents of Boc (cleaved by thermal treatment during the process of membrane fabrication) and CO^{t}Bu groups tend to show much better compatibility with polyimide than Noria itself, resulting in homogeneous dispersion of nanoaggregates and fine adhesion between the two phases in the derived Noria/6FDA-DAM and Noria-CO^{t}Bu/6FDA-DAM MMMs. Gas permeation tests revealed that Noria and Noria-CO^{t}Bu nanoparticles have different effect on gas separation performance of MMMs. The introduction of Noria into 6FDA-DAM tends to enhance CO_2/CH_4 selectivity and thus improve its gas separation properties, though a decrease in the observed permeability could be observed. In contrast, the introduction of Noria-CO^{t}Bu with higher surface area and larger pores tends to increase the free volume and gas permeability of MMMs. These results show that both the morphology and the gas separation properties of MMMs could be tuned by tailoring the structures of porous organic cages.