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www.elsevier.com/locate/memsci

PII: S0376-7388(16)31669-6
DOI: http://dx.doi.org/10.1016/j.memsci.2016.12.068
Reference: MEMSCI15035

To appear in: *Journal of Membrane Science*

Received date: 18 September 2016
Revised date: 9 December 2016
Accepted date: 10 December 2016

Cite this article as: Moon Joo Lee, Hyuk Taek Kwon and Hae-Kwon Jeong Defect-dependent Stability of Highly Propylene-Selective Zeolitic-Imidazolat Framework ZIF-8 Membranes, *Journal of Membrane Science* http://dx.doi.org/10.1016/j.memsci.2016.12.068

Defect-dependent Stability of Highly Propylene-Selective Zeolitic-Imidazolate Framework ZIF-8 Membranes

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Abstract

Membranes of ZIF-8, a prototypical zeolitic-imidazolate framework (ZIF) with a sodalite topology, have shown excellent propylene/propane separation performances based on molecular sieving mechanism. Although the long-term stability of ZIF-8 membranes is of critical importance for their practical applications, there are only a few studies reported on the subject. Here, we report the long-term binary propylene/propane performances of ZIF-8 membranes prepared by two distinctive synthesis methods. A series of characterizations was employed to explain how different synthetic protocols led to the formation of ZIF-8 membranes with different bulk defect densities and surface defects, thereby affecting the long-term membrane stability. Finally, a post-synthetic ligand treatment is proposed as an effective means to mitigate the defects of ZIF-8 membranes, resulting in improved long-term separation performances.

Keywords: Zeolitic-imidazolate frameworks, gas separation, membranes, defects, long-term stability