Tubular C/Cu decorated γ-alumina membranes for NO abatement

Iakovos Yakoumis, George Theodorakopoulos, Sergios K. Papageorgiou, George Romanos, Charitomeni Veziri, Dimitrios Panias

www.elsevier.com/locate/memsci

PII: S0376-7388(16)30481-1
DOI: http://dx.doi.org/10.1016/j.memsci.2016.05.047
Reference: MEMSCI14522

To appear in: *Journal of Membrane Science*

Received date: 19 April 2016
Revised date: 16 May 2016
Accepted date: 27 May 2016

Cite this article as: Iakovos Yakoumis, George Theodorakopoulos, Sergios K Papageorgiou, George Romanos, Charitomeni Veziri and Dimitrios Panias Tubular C/Cu decorated γ-alumina membranes for NO abatement, *Journal o Membrane Science,* http://dx.doi.org/10.1016/j.memsci.2016.05.047

Tubular C/Cu decorated γ-alumina membranes for NO abatement

Iakovos Yakoumis[a*], George Theodorakopoulos[a], Sergios K. Papageorgiou[b*], George Romanos[b], Charitomeni Veziri[b], Dimitrios Panias[c]

[a]Monolithos Catalysts and Recycling Ltd, 11476 Polygono, Athens, Greece

[b]Institute of Nanoscience and Nanotechnology, N.C.S.R. "Demokritos", 15310 Ag. Paraskevi, Athens, Greece

[c]School of Mining and Metallurgical Engineering, National Technical University of Athens, Zografou Campus, Athens, Greece

yakoumis@monolithos-catalysts.gr

s.papageorgiou@inn.demokritos.gr

[*]Corresponding authors

Abstract

In this work, tubular γ-alumina ultrafiltration membranes have been modified with a sodium alginate/α-alumina suspension based on a modified polyol process in order to be used as forced flow membrane reactors. A C/Cu nanocomposite layer containing Cu nanoparticles of small and uniform size (ca. 14 nm) was deposited and stabilized on the external and internal surface of the membrane. The structural, morphological and gas permeance properties of the obtained catalytic membranes have been studied and their $DeNO_x$ performance has been evaluated in flow through mode of operation. NO catalytic abatement evaluation in flow through dead-end mode with 1% NO in N_2 fed from shell to lumen showed high efficiency even at low temperatures and reached 75% at 400°C. Steady state NO conversion efficiency reached about 30% at 400°C and heat treatment in He atmosphere at 440°C revealed the role of NO sorption onto the carbon dressing.

Keywords: Tubular catalytic membranes; Forced flow membrane reactor; Alginate; Cu nanoparticles; NO abatement.

1. Introduction

Carbon materials have been extensively used as nanoparticles (NPs) supports in gases purification. Activated carbon itself can reduce NO_x to N_2 without addition of an external reducing agent [1-3] with the reaction between NO and carbonaceous materials normally occurring at temperatures above 500°C [4] depending on the chemical and porous properties of carbon [5, 6]. A significant decrease of the temperature required for NO_x reduction [7, 8] can be achieved, when metal (alkali, alkaline-earth or some transition metals – Cr, Fe, Co, Ni and Cu) carbon supported catalysts are employed [9-13]. However, the formation of oxygen during NO_x dissociation may deteriorate the carbon