Electronic Supplementary Material (ESI) for RSC Advances.

Supplementary data

Hydrogen Production via Silica Membrane Reactor during Methanol Steam Reforming Process: Experimental Study

Kamran Ghasemzadeh[1], Abbas Aghaeinejad-Meybodi[1], Mohammad Javad Vaezi[1], Ahmad Gholizadeh[1], Mohammad Adel Abdi[1], Ali Akbar Babaluo [*1], Mohammad Haghighi[2], Angelo Basile[3]

[1]Nanostructure Material Research Center (NMRC), Chemical Engineering Department, Sahand University of Technology, Tabriz, Iran.

[2]Reactor and Catalysis Research Center (RCRC), Chemical Engineering Department, Sahand University of Technology, Tabriz, Iran.

[3]ITM-CNR,c/o University of Calabria, Via Pietro Bucci, Cubo 17/C, 87036 Rende (CS), Italy.

[*]Corresponding author: a.babaluo@sut.ac.ir

Tel.: +98 41 3345 9081; fax: +98 41 3344 4355

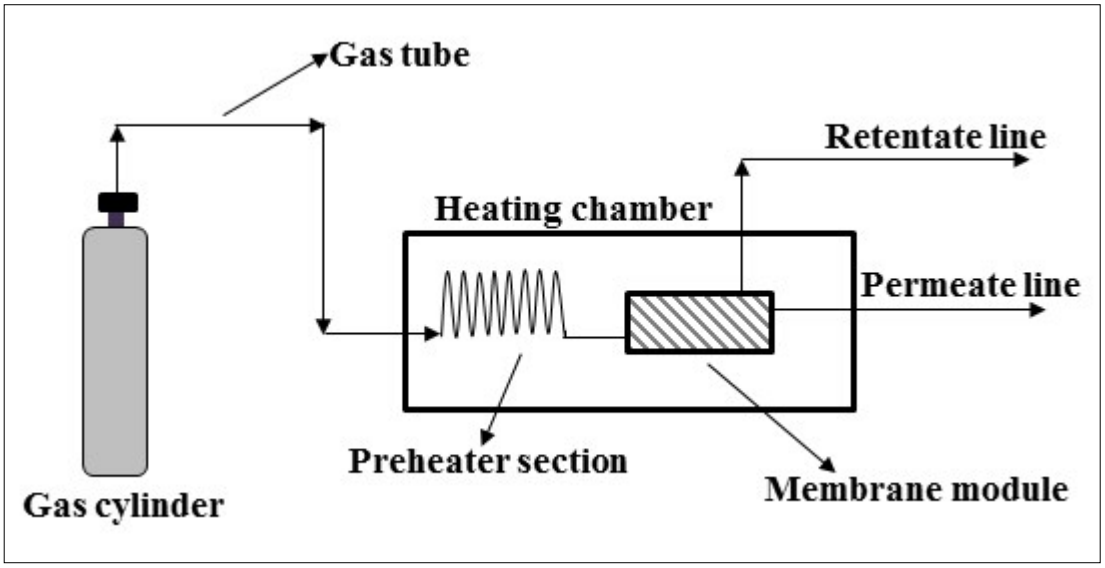

Fig.S1: Schematic of permeation test set up.

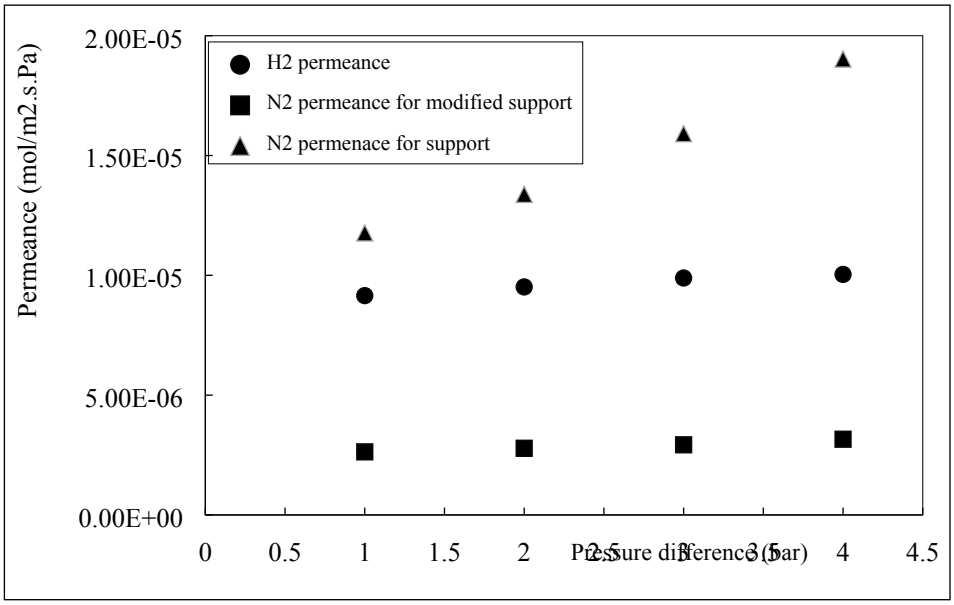

Fig.S2: Pure gas permeance of unmodified support and modified γ–alumina support at room temperature.

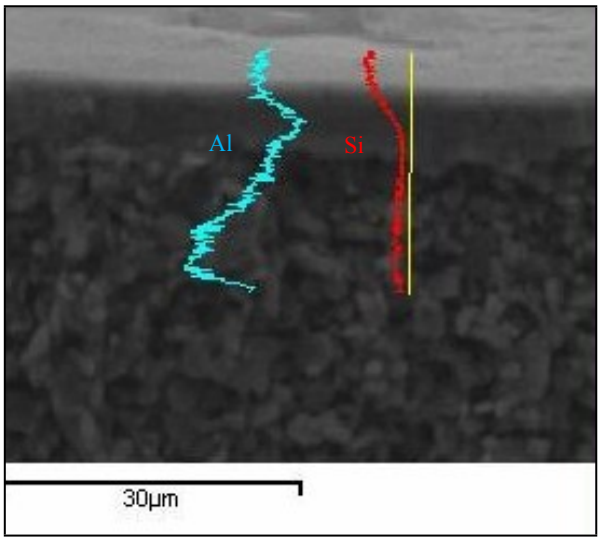

Fig.S3: EDAX image for analysis of silica and alumina distribution in structure of the synthesized membrane.

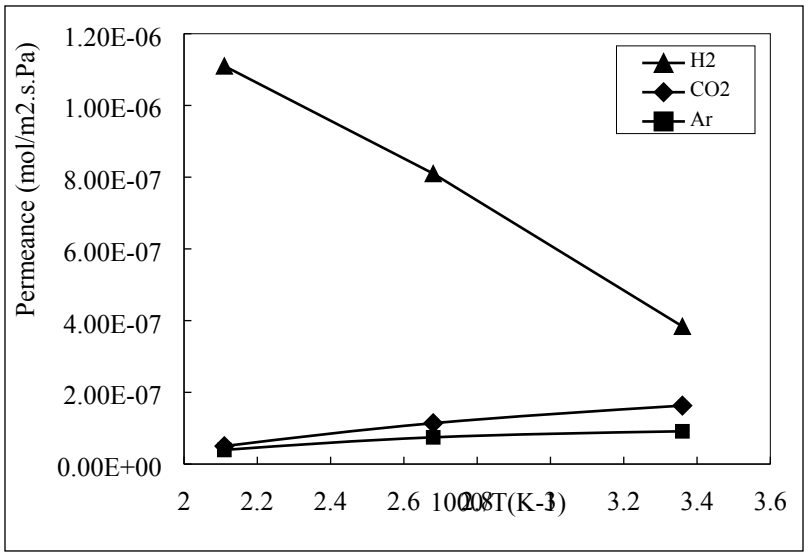

Fig.S4: the temperature effects on the pure gases permeance for silica membrane at ΔP=2bar.

Table S1. Permselectivity values of H_2/N_2 versus pressure difference for modified γ–alumina support.

	Δp=1 bar	Δp=2 bar	Δp=3 bar	Δp=4 bar
H_2/N_2 permselectivity of modified γ-alumina support with particle size control	3.48	3.41	3.37	3.22
H_2/N_2 permselectivity of modified γ–alumina support without particle size control	3.40	3.37	3.20	3.10

Table S2. Molar fraction of components in the permeate and retentate stream for silica MR from in comparison with TR (at 300 ^{o}C, 2 bar, feed molar ratio 3 and GHSV= 10000 h^{-1})

Components	H_2	CO_2	CO	Ar
Molar fraction in retentate side (%)	29.50	11.5	0.85	58.15
Molar fraction in permeate side (%)	52.48	9.00	0.5	38.02
Mole fraction in TR (%)	30.49	9.40	0.95	59.16