# Supplementary file

Facile One-Pot Synthesis of PdM (M=Ag, Ni, Cu, Y) Nanowires for use in Mixed Matrix Membranes for Efficient Hydrogen Separation

Abhishek Kumar[1], Liang Huang[1], Leiqing Hu[1], Deqiang Yin[1], Haiqing Lin[1], Mark T. Swihart[1,2*]*
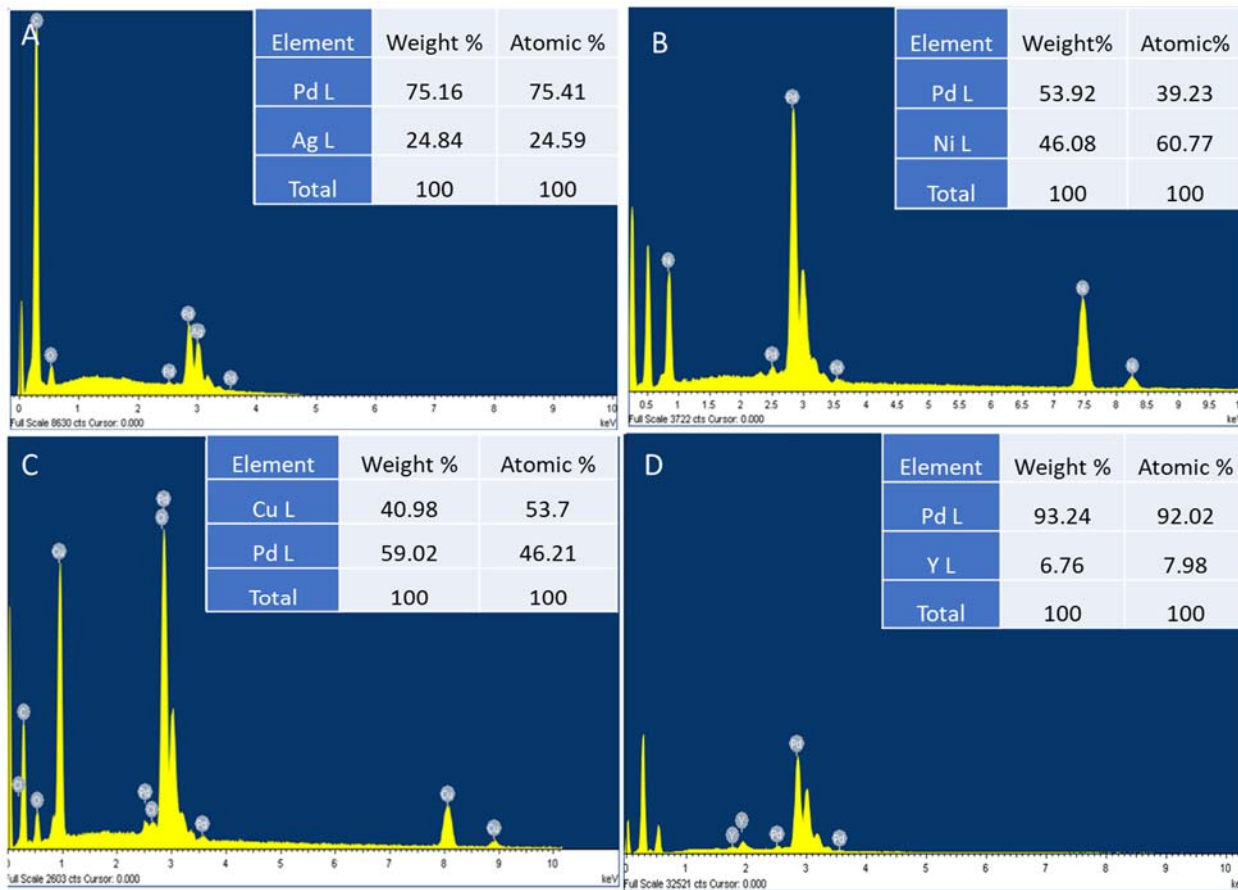
[1] Department of Chemical and Biological Engineering, University at Buffalo, The State University of New York (SUNY)

[2] RENEW Institute, University at Buffalo (SUNY), The State University of New York (SUNY)
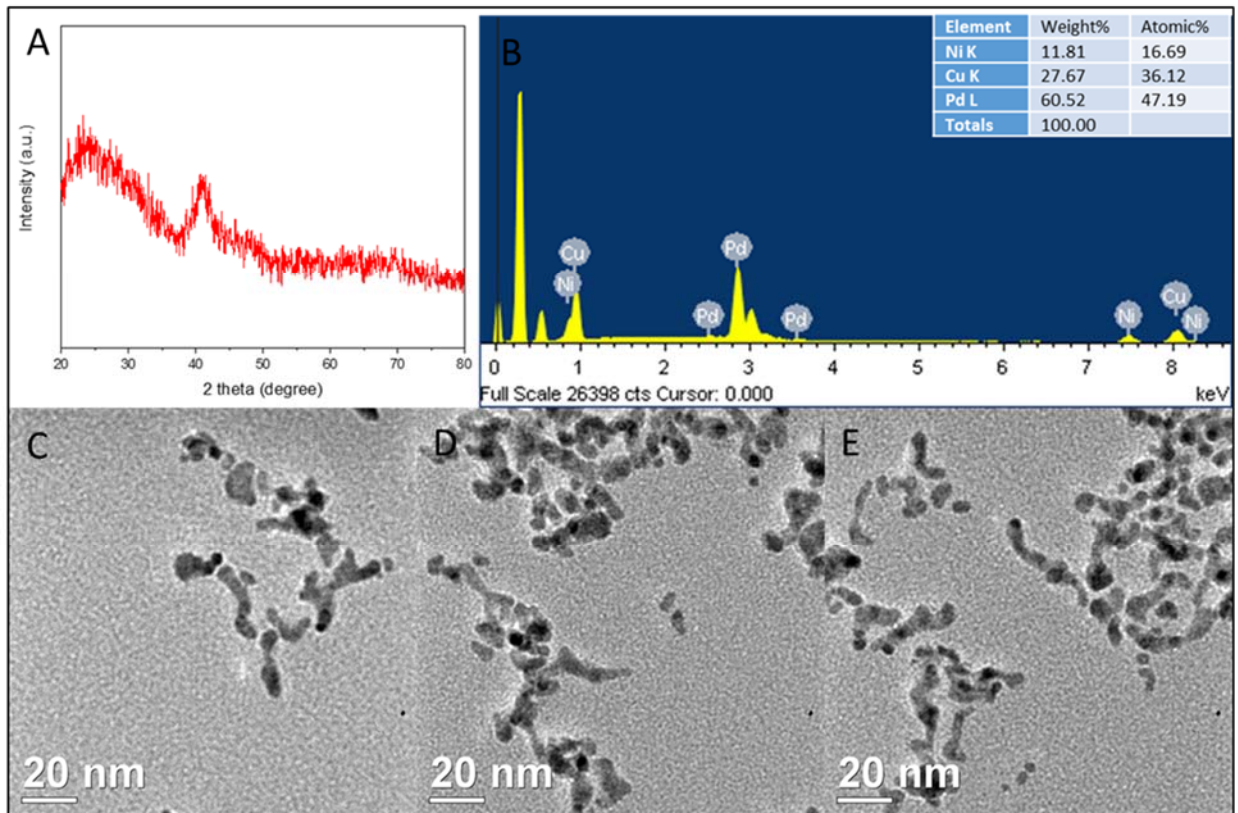
E-mail : haiqingl@buffalo.edu; swihart@buffalo.edu
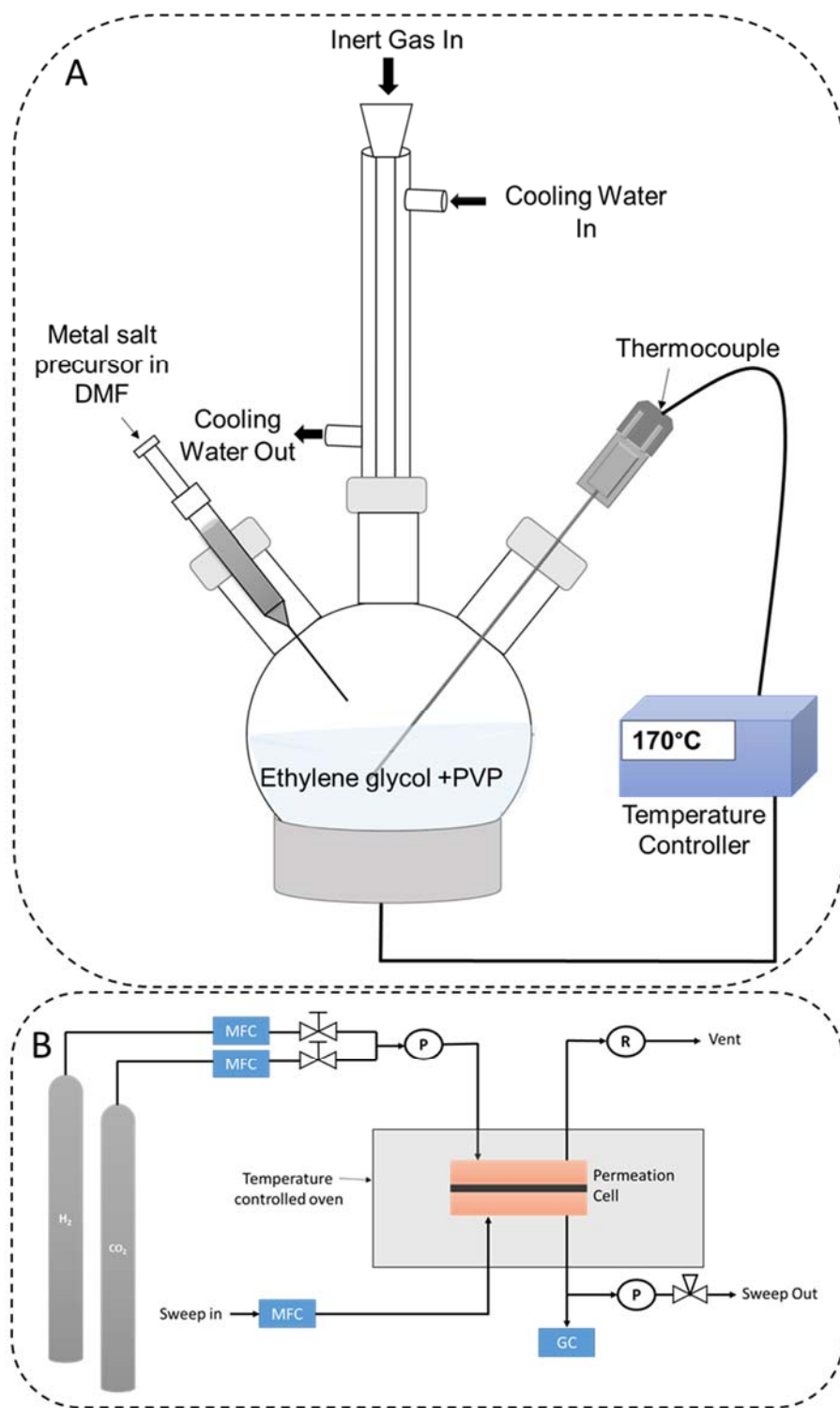
Figure S1. **A)** Schematic of polyol synthesis of Pd and Pd-based nanowires; **B)** Schematic of gas separation setup
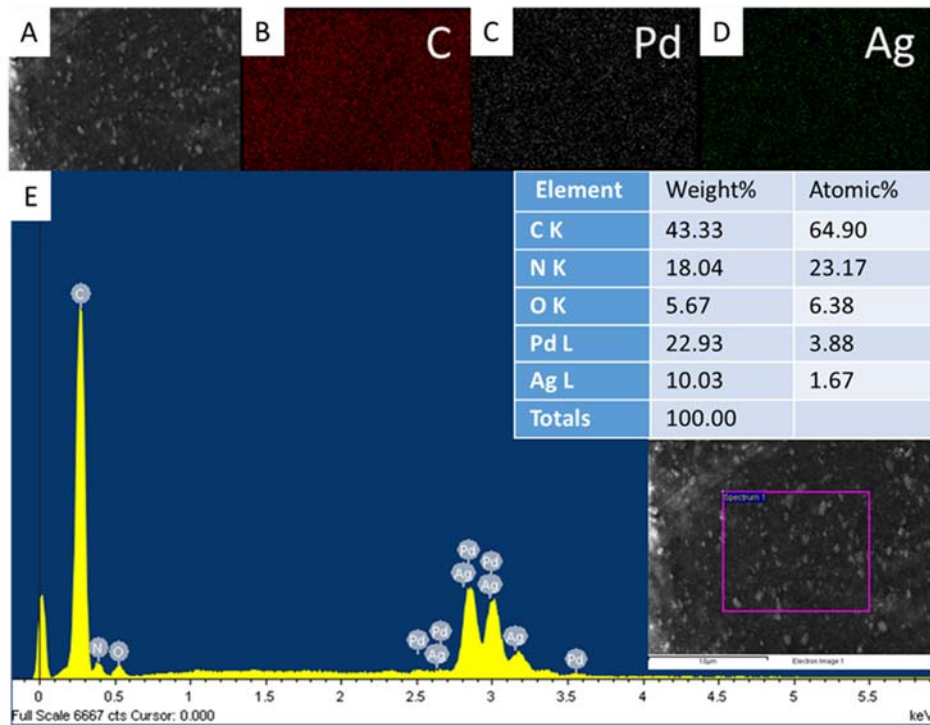
Figure S2. EDS area scan results showing elemental composition and the ratios of metals in **A)** $Pd_{0.74}Ag_{0.26}$ nanowires, **B)** $Pd_{0.4}Ni_{0.6}$ nanowires, **C)** $Pd_{0.53}Cu_{0.46}$ nanowires, **D)** $Pd_{0.92}Y_{0.08}$ nanowire

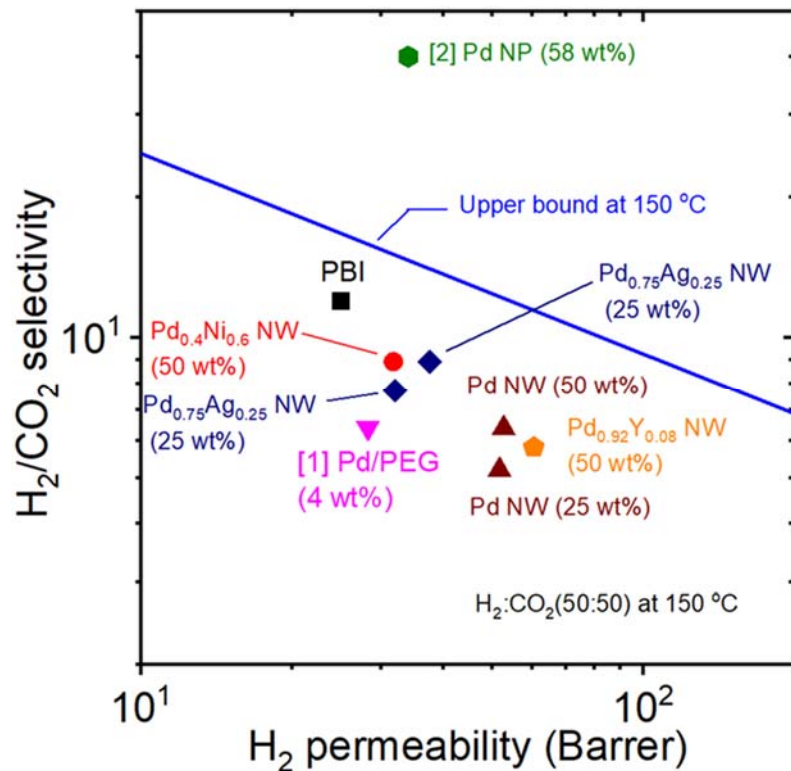| Element	Weight%	Atomic%
Ni K	11.81	16.69
Cu K	27.67	36.12
Pd L	60.52	47.19
Totals	100.00	

Full Scale 26398 cts Cursor: 0.000

Figure S3: A) XRD pattern of PdCuNi NWs; **B)** EDS spectra of PdCuNi NWs; **C-E)** TEM images of PdCuNi NWs
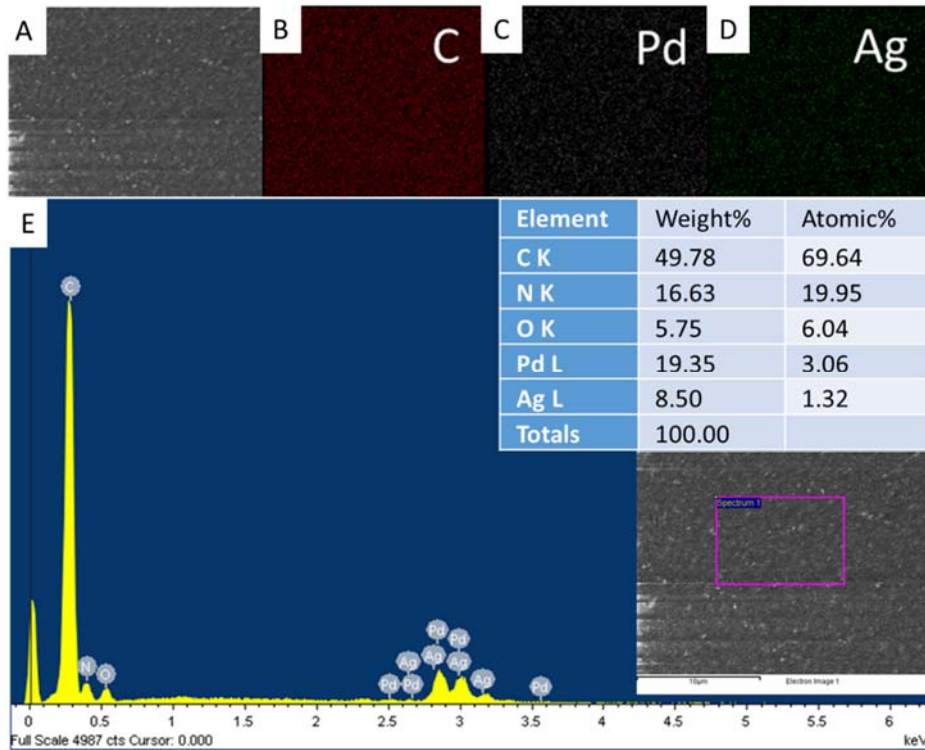
Figure S4: **(A)** SEM image and corresponding elemental mapping of **(B)** C; **(C)** Pd; **(D)** Ag; **(E)** EDS spectra of top part of PdAgNW/PBI-MMM

Element	Weight%	Atomic%
C K	49.78	69.64
N K	16.63	19.95
O K	5.75	6.04
Pd L	19.35	3.06
Ag L	8.50	1.32
Totals	100.00	

Figure S5 (A) SEM image and corresponding elemental mapping of **(B)** C; **(C)** Pd; **(D)** Ag; **(E)** EDS spectra of bottom part of PdAg NW/PBI-MMM

Element	Weight%	Atomic%
C K	43.33	64.90
N K	18.04	23.17
O K	5.67	6.38
Pd L	22.93	3.88
Ag L	10.03	1.67
Totals	100.00	

Figure S6: Mixed-gas separation performance of PdM NW/PBI-MMMs at 150 °C versus Robeson's 2008 upper bound (the blue line) at 150 °C

[1]   H. S. M. Suhaimi, C. P. Leo and A. L. Ahmad, *Chem. Eng. Technol.*, 2017, **40**, 631–638.

[2]   L. Zhu, D. Yin, Y. Qin, S. Konda, S. Zhang, A. Zhu, S. Liu, T. Xu, M. T. Swihart and H. Lin, *Adv. Funct. Mater.*, 2019, **29**, 1904357.

Table S1: Pure-gas H_2 sorption and solubility of PdAg NW/PBI-MMM evaluated at 150 °C

Pressure (bar)	Sorption (cm^3(STP)/ cm^3)	Solubility (cm^3 (STP)/ cm^3 atm)	Diffusivity (10^{-8} cm^2/s)
4.45	6.90	1.57	18.4
7.89	8.76	1.13	25.6
11.35	14.17	1.27	22.7