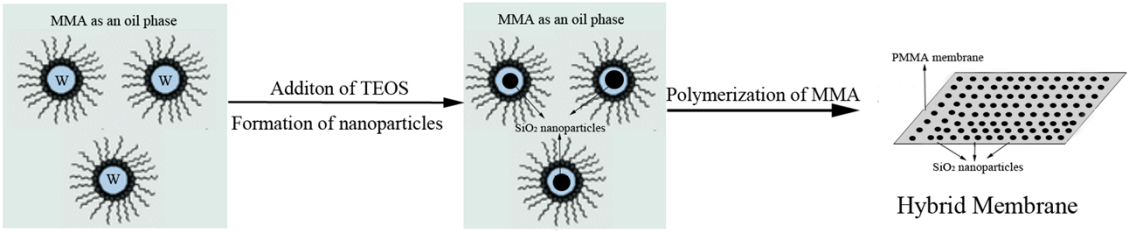
Electronic Supplementary Material (ESI) for RSC Advances.



Scheme S1 Preparation of SiO_2/PMMA by in-situ microemulsion polymerization

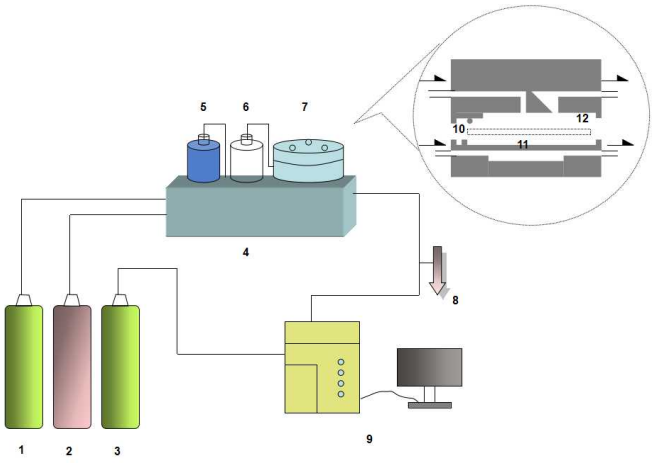


Figure S1 Experimental setup for gas permeation measurements

1. H_2; 2. CO_2/N_2 mixture; 3. H_2; 4. thermostatic water bath; 5. humidifying tank; 6. wiping off cold coagulation tank; 7. infiltration ponds; 8. soap-film flowmeter; 9. GC; 10. membrane; 11. porous metal disk; 12.O-ring seal

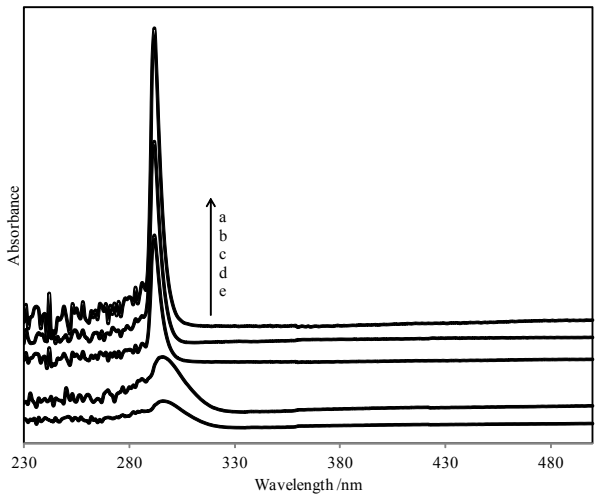


Figure S2 Evolution of UV-visible absorption spectra of microemulsion with different SiO_2 contents(wt%): a. 5.0; b. 4.0; c. 3.0; d. 2.0; and e. 1.0.

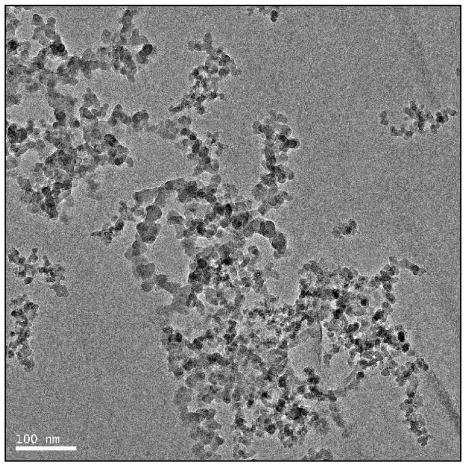


Figure S3 TEM micrographs of SiO_2 nanoparticles in the microemulsion at SiO_2 content of 1.0 wt%

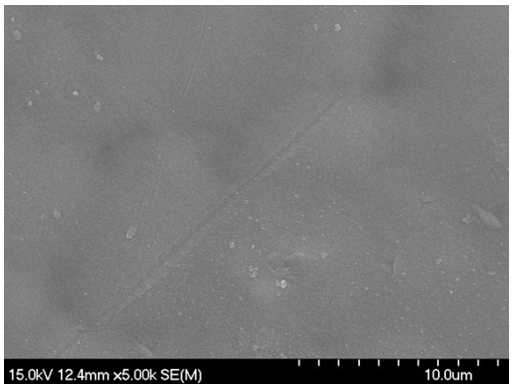


Figure S4 SEM micrographs of the surface of SiO_2/PMMA hybrid membranes at SiO_2 content of 1.0 wt%

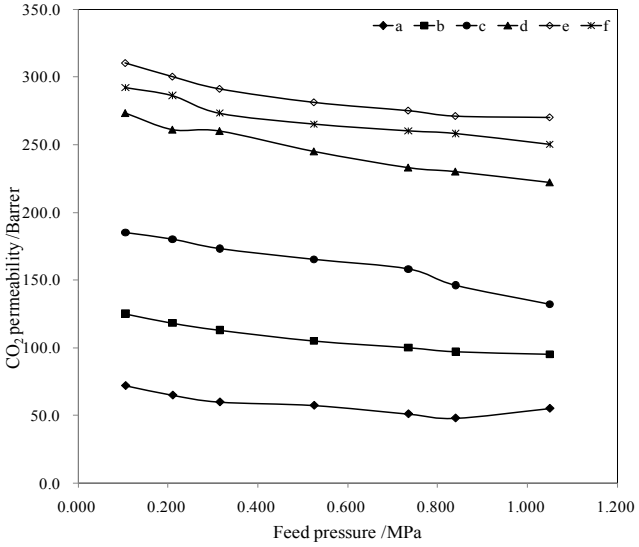


Figure S5 Effect of feed pressure on the CO_2 permeability of different SiO_2/PMMA membranes at SiO_2 content of: a. 0.0 wt%; b.1.0 wt%; c.2.0 wt%; d. 3.0 wt%; e. 4.0 wt% and f. 5.0 wt%

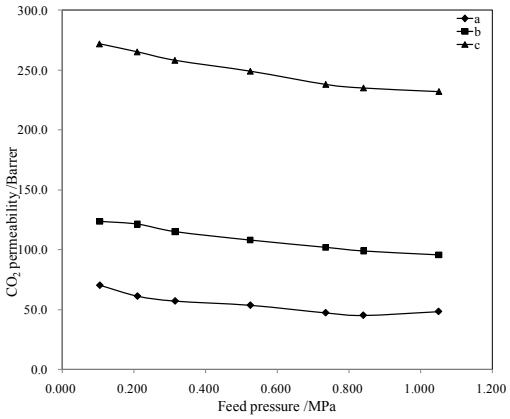


Figure S6 Effect of feed pressure on the CO_2 permeability (Gas mixture, volume ratio of CO_2/N_2 are 9:1)
SiO_2 content in hybrid membrane: a. 0.0 wt%; b.1.0 wt% and c. 3.0 wt% %

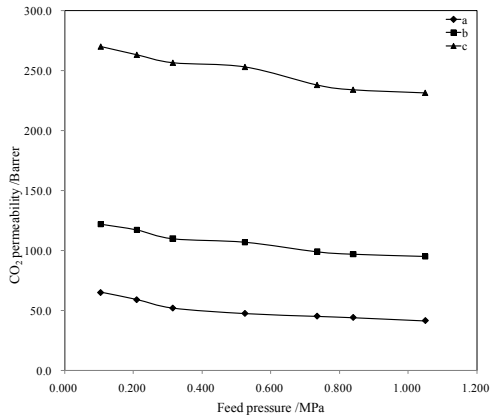


Figure S7 Effect of feed pressure on the CO_2 permeability (Gas mixture, volume ratio of CO_2/N_2 are 5:5)
SiO_2 content in hybrid membrane: a. 0.0 wt%; b.1.0 wt% and c. 3.0 wt% %

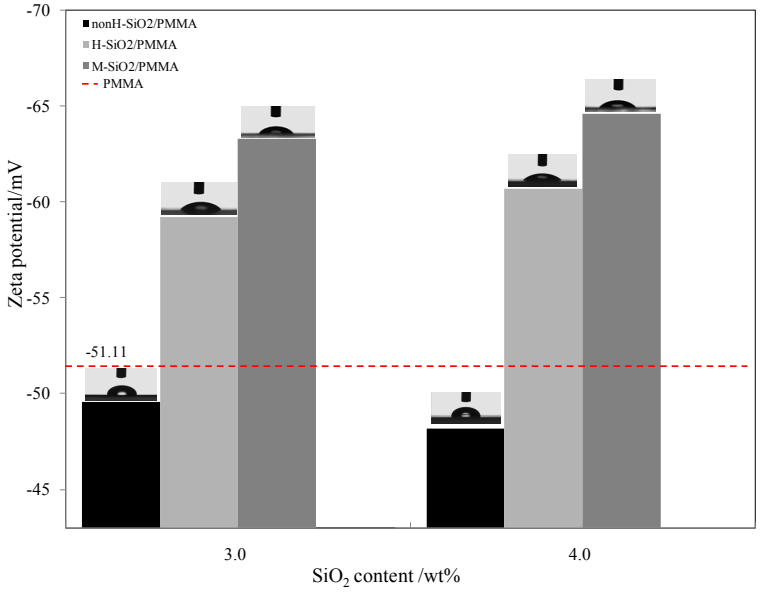


Figure **S8** The zeta potential values and water contact angles of different hybrid membranes containing different SiO_2 nanoparticles