

Thermochemical stability of zeolitic imidazolate frameworks (ZIFs) membrane: Criticality of the membrane/support interface chemistry and its modulation for membrane reactor application.

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Abstract: Thermochemical stability of MOFs membrane is vital for the deployment in versatile chemical reaction processes, yet detailed studies and understanding on the structure–property relationship of MOFs membrane, beyond those of MOFs micro- and nanocrystals, under antagonistic reaction environment is still lacking. A simple surface modification of common porous Al₂O₃ supports by tuning acid-base chemistry at the membrane/support interface drastically enhances the hydrothermal stability of ZIFs membrane, which permits the first application of MOFs membrane for membrane reactor (MBR) under highly hostile chemical reaction environment. Applied to the catalytic water-gas shift reaction ($\text{CO} + \text{H}_2\text{O} \leftrightarrow \text{CO}_2 + \text{H}_2$) at unprecedented high temperatures (473 – 673 K), the ZIF-MBR provides considerable increases in the product yields over the conventional packed bed reactor via a concomitant and selective separation of H₂ from the products by size discrimination which allows the yields even above the thermodynamic equilibrium level.

Keywords: metal organic framework, thermochemical stability, membrane reactor