# Enhanced $CO_2/N_2$ separation performance of polyimide-based mixed-matrix membranes with functionalized porous organic fillers

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A novel porous polymer (denoted as PBP) was synthesized via Friedel-Crafts alkylation. Subsequently, post-synthetic functionalization with the use of sulfonic and amine groups was performed on PBP to improve the overall $CO_2$ adsorption. These developed porous materials were incorporated into in-house polyimide to obtain mixed-matrix membranes (MMMs) for $CO_2/N_2$ separation process. It was observed that the incorporation of these functional groups was feasible to improve $CO_2$ adsorption due to the presence of strong interaction between $CO_2$ and the selected functional groups. Gas permeation results of the MMMs demonstrated that $CO_2$ separation performance can be improved substantially with the incorporation of porous fillers. On the other hand, functionalized porous fillers were feasible to tune $CO_2/N_2$ separation performance towards a favorable direction. In particular, PBP-menm yielded the greatest gas separation performance among all selected porous fillers, resulting in an excellent performance beyond the Robeson upper bound limit for $CO_2/N_2$ separation.