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Synthesis of porous polymer-based metal–organic frameworks monolithic hybrid composite for hydrogen storage application

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ABSTRACT:

Herein, we report a simple method for the preparation of cross-linked polymer of intrinsic microporosity (PIM-1)/Materials Institute Lavoisier chromium (III) terephthalate [MIL-101(Cr)] monoliths which involves direct impregnation of PIM-1 with MIL-101(Cr) powder by physical mixing in tetrachloroethane solvent. This procedure yields monoliths with high metal–organic framework (MOF) loading weight percentages of up to 80 wt% of MIL-101 powder with little loss of composite mechanical strength. From the nitrogen adsorption isotherms, it was observed that the PIM-1/80 wt% MIL-101(Cr) had good retention of MOF filler surface area and accessibility of its micropores with nearly no pore blocking effects. The hydrogen adsorption was also not far from the estimated hydrogen uptake capacity based on the MIL-101 weight percentage estimation. As a consequence of the highly porous nature of the hybrid material, PIM-1/MIL-101(Cr) composite has been considered as a promising material for inclusion in hybrid hydrogen storage cylinders. Moreover, these composites provided better handling compared to the crystalline powder MOFs without compromising the properties of MOF.