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## Enhancing gas adsorption through HKUST-1 hybridization with activated carbons

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This study explores the potential of HKUST-1 composites for gas adsorption. We conducted an investigation to assess the impact of hybridizing metal-organic frameworks (MOFs) with 4 different activated carbons (ACs) having specific surface area ( $A_{\text{BET}}$ ) ranging from 985 to 3305  $\text{m}^2/\text{g}$  on the textural properties and gas sorption capacities of the resulting composites [1]. The incorporation of these ACs led to modifications in the pore size distribution and  $A_{\text{BET}}$  of the resulting hybrids, which aligns with findings from previous studies [2], [3]. The primary objective of this research is to evaluate the effectiveness of these hybrid, synthesized using AC to HKUST-1 ratios between 1% and 10%, in adsorbing  $\text{CO}_2$  and  $\text{H}_2$ . Fig 1a) shows the nitrogen adsorption-desorption isotherms at 77K and Fig 1 b) illustrates the changes in  $A_{\text{BET}}$  for the hybrids prepared by addition of increasing percentages of Filtrasorb 400 to HKUST-1. Additionally, we will present a comprehensive characterization of the materials, along with experimental data on the sorption capacities of the composites under different pressure and temperature conditions.

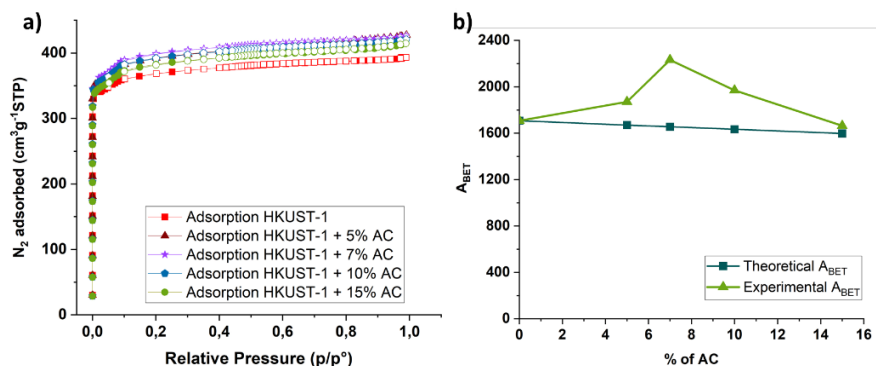


Fig. 1. a) nitrogen adsorption-desorption isotherms at 77K of the for the hybrids prepared by addition of increasing percentages of Filtrasorb 400 to HKUST-1; b) illustrates the changes in  $A_{\text{BET}}$  comparing the theoretical and experimental values.

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### References:

- [1] P. Ramirez-Vidal *et al.*, ‘A Step Forward in Understanding the Hydrogen Adsorption and Compression on Activated Carbons’, *ACS Appl. Mater. Interfaces*, vol. 13, no. 10, pp. 12562–12574, Mar. 2021, doi: 10.1021/acsami.0c22192.
- [2] E. Rojas-Garcia, *et al.* ‘Enhancing in the hydrogen storage by SWCNT/HKUST-1 composites: Effect of SWCNT amount’, *Catal. Today*, vol. 394–396, pp. 357–364, Jul. 2022, doi: 10.1016/j.cattod.2021.08.004.

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- [3] A. Policicchio et al. 'Enhancing the gas adsorption capacities of UiO-66 by nanographite addition', *Microporous Mesoporous Mater.*, vol. 309, p. 110571, Dec. 2020, doi: 10.1016/j.micromeso.2020.110571.