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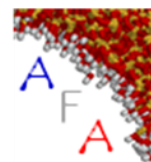
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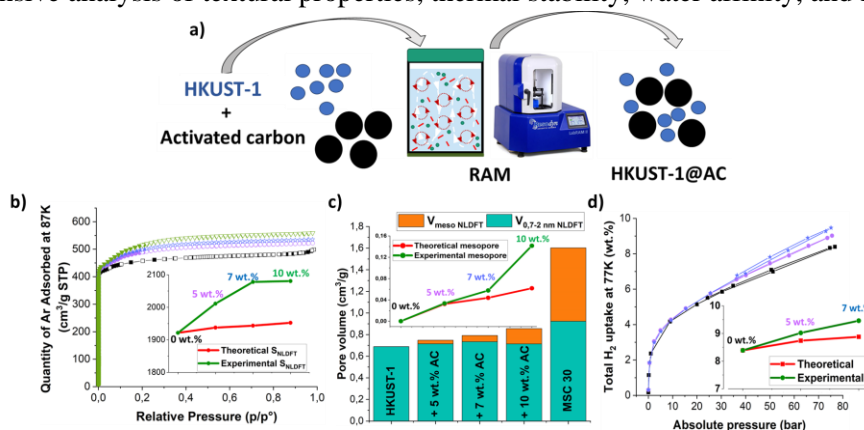
## Utilizing Resonant Acoustic Mixing to Combine HKUST-1 with Activated Carbon for Hydrogen Adsorption Applications

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Metal-organic frameworks (MOFs) have emerged as highly promising candidates for hydrogen storage due to their adaptable porosity, large surface area, and the possibility to functionalize them for particular applications [1]. Incorporating carbon-based materials into the MOF matrix has proven effective in increasing specific surface area of the resulting composite material, thereby enhancing its adsorption capacity [2]. This study focuses on assessing the impact of introducing a commercial activated carbon (AC, MSC 30 from Kansai Coke and Chemicals Co., Ltd.) into the HKUST-1 matrix. This assessment involves comprehensive analysis of textural properties, thermal stability, water affinity, and H<sub>2</sub> uptake.



**Fig. 1.** a) Schematic representation of the synthesis process; b) Ar isotherms at 87K and, theoretical vs experimental  $S_{NLDFT}$  (insert); c) Pore volumes and, theoretical vs experimental mesopore volume (insert); d) Total H<sub>2</sub> uptake at 77K and theoretical vs experimental total H<sub>2</sub> uptakes (insert)

Incorporating varying weight percentages of AC into HKUST-1 enhanced the textural characteristics of the resultant composite materials by increasing the mesopore volume. The total H<sub>2</sub> uptake increased by 3.7% and 6.8% with the addition of 5 and 7 wt.%, respectively, of AC, surpassing the theoretical H<sub>2</sub> capacities. These theoretical capacities were calculated by considering the mass percentages of HKUST-1 and AC, assuming a linear additive effect. The heightened H<sub>2</sub> uptake is ascribed to the higher mesopore volume in the composites.

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#### Références:

- [1] S. Bordiga et al., 'Adsorption properties of HKUST-1 toward hydrogen and other small molecules monitored by IR', *Phys. Chem. Chem. Phys.*, vol. 9, no. 21, pp. 2676–2685, May 2007, doi: 10.1039/B703643D.
- [2] A. Policicchio et al., 'Enhancing the gas adsorption capacities of UiO-66 by nanographite addition', *Microporous and Mesoporous Materials*, vol. 309, p. 110571, Dec. 2020, doi: 10.1016/j.micromeso.2020.110571.