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Potassium Tethered Carbons with Unparalleled Adsorption Capacity and Selectivity for Low-Cost Carbon Dioxide Capture from Flue Gas

Hongyu Zhao,[a,b] Lei Shi, [a,c] Zhongzheng Zhang, [a] Xiaona Luo, [a,b] Lina Zhang, [a] Qun Shen, [a] Shenggang Li, [a,d] Haijiao Zhang, [b] Nannan Sun,* [a] Wei Wei,* [a,d,e] and Yuhan Sun [a,d]

a. CAS Key Lab of Low-Carbon Conversion Science and Engineering, Shanghai Advanced Research Institute, Chinese Academy of Sciences, Shanghai 201210, China.

b. Institute of Nanochemistry and Nanobiology, School of Environmental and Chemical Engineering, Shanghai University, Shanghai 200444, China.

c. Department of Chemistry, Shanghai University, Shanghai 200444, China.

d. School of Physical Science and Technology, ShanghaiTech University, Shanghai 201210, China.

e. Center for Excellence in Urban Atmospheric Environment, Institute of Urban Environment, Chinese Academy of Sciences, Xiamen, 361021, China.

Corresponding author: sunnn@sari.ac.cn, weiwei@sari.edu.cn

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ABSTRACT: Carbons are considered less favorable for post-combustion CO_2 capture because of their low affinity toward CO_2, and nitrogen doping was widely studied to enhance CO_2 adsorption, but the results are still unsatisfactory. [1] Herein, we report a simple, scalable, and controllable strategy of tethering potassium to a carbon matrix, which can enhance carbon−CO_2 interaction effectively, and a remarkable working capacity of ca. 4.5 wt % under flue gas conditions was achieved, which is among the highest for carbon-based materials.[2] More interestingly, a high CO_2/N_2 selectivity of 404 was obtained.[3] Density functional theory calculations evidenced that the introduced potassium carboxylate moieties are responsible for such excellent performances. We also show the effectiveness of this strategy to be universal, and thus, cheaper precursors can be used, holding great promise for low-cost carbon capture from flue gas.

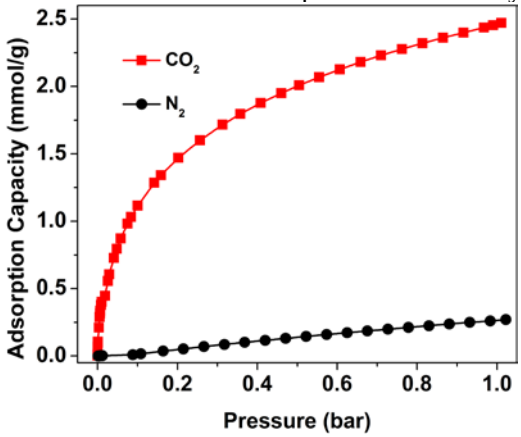

Figure 1. Comparison of CO_2 and N_2 isotherms of MC-60ox-K at 25 °C.

Table 1. CO_2 adsorption capacities of parent carbons, oxidized carbons and PTCs measured by gravimetric method

Sample code	15 vol.% CO_2		100 vol.% CO_2	
	40 °C/ wt.%	75 °C / wt.%	40 °C / wt.%	75 °C / wt.%
MC	2.36	0.94	6.56	3.38
MC-60ox	3.00	1.13	6.73	3.42
MC-60ox-K	4.52	2.36	7.70	4.80
MC-80ox-K	5.76	3.21	7.70	4.51
CB	1.00	0.54	2.22	1.12
CB-60ox	2.04	0.75	4.20	2.07
CB-60ox-K	3.97	1.93	5.78	3.46
AC	1.30	0.57	4.4	2.03
AC-60ox	2.91	1.03	5.19	2.59
AC-60ox-K	2.81	1.81	3.17	2.37

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