ARTICLE

The mechanochemical process to capture carbon dioxide gas and separate from natural gas with boron nitride nanosheets.

Received 00th January 20xx,
Accepted 00th January 20xx

DOI: 10.1039/x0xx00000x

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Electronic Supplementary Information (ESI) available: [details of any supplementary information available should be included here]. See DOI: 10.1039/x0xx00000x

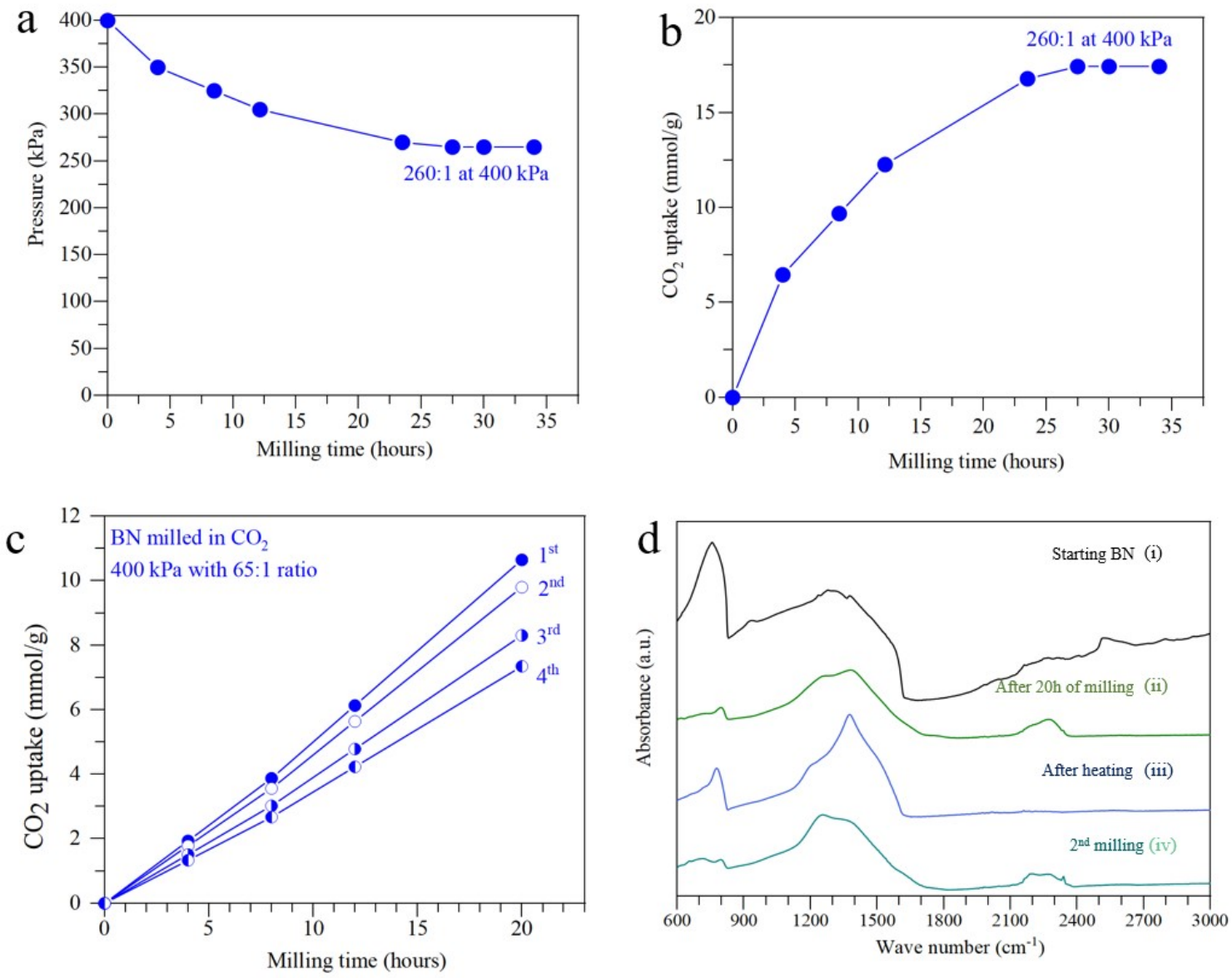

Figure S1: Maximum adsorption capacity with 1 g of BN: a) pressure drop curve b) uptake capacity 1 gram of BN milled in CO_2. (c) the uptake of CO2 by BN during milling of (1) fresh BN in CO_2 (1) and (2) heated BN and repeated 2nd cycle and 3rd and 4th cycles. (d) FTIR spectra of the initial BN powder and the BN samples after milling and heating treatments.

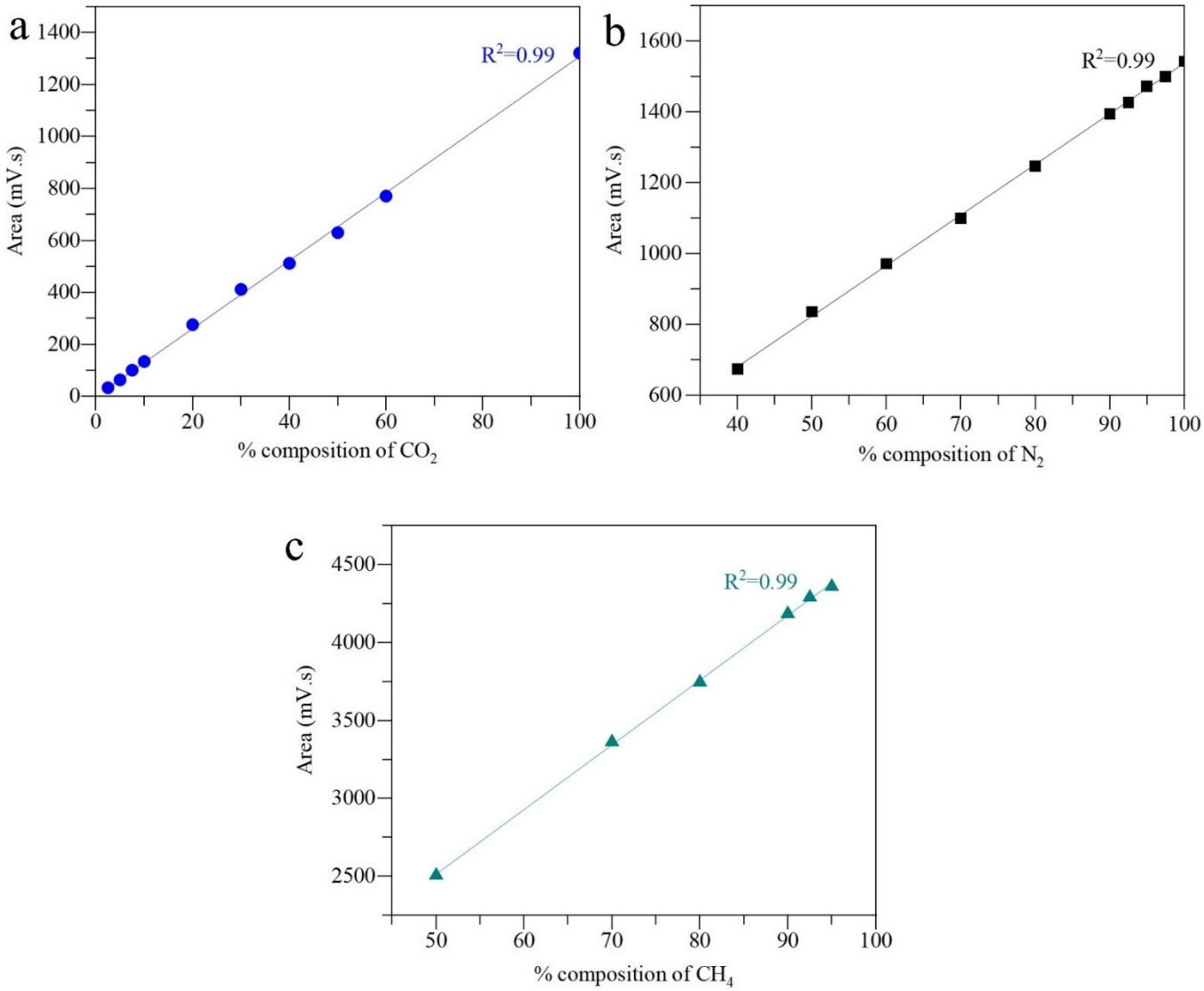

Figure S2: Calibration of different amounts of gases using gas-chromatography (a) CO_2, (b) N_2, (c) CH_4.

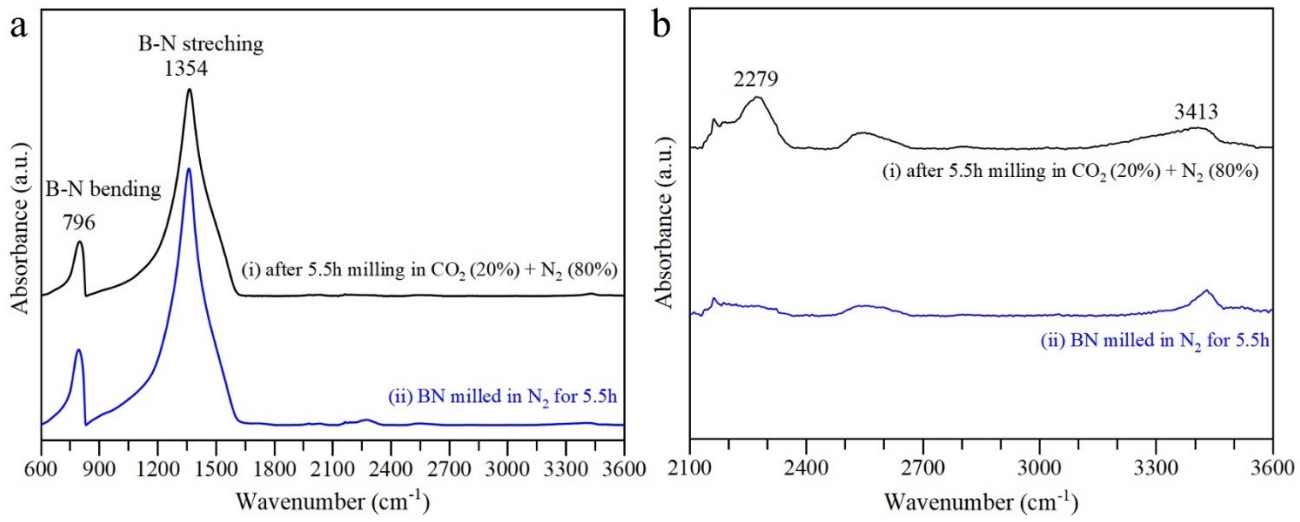

Figure S3: FTIR spectra of the BN milled for 5.5 hours in a mixture gas of CO_2+N_2 (i) and in N_2 (ii); (b) Enlarged spectra of the same.

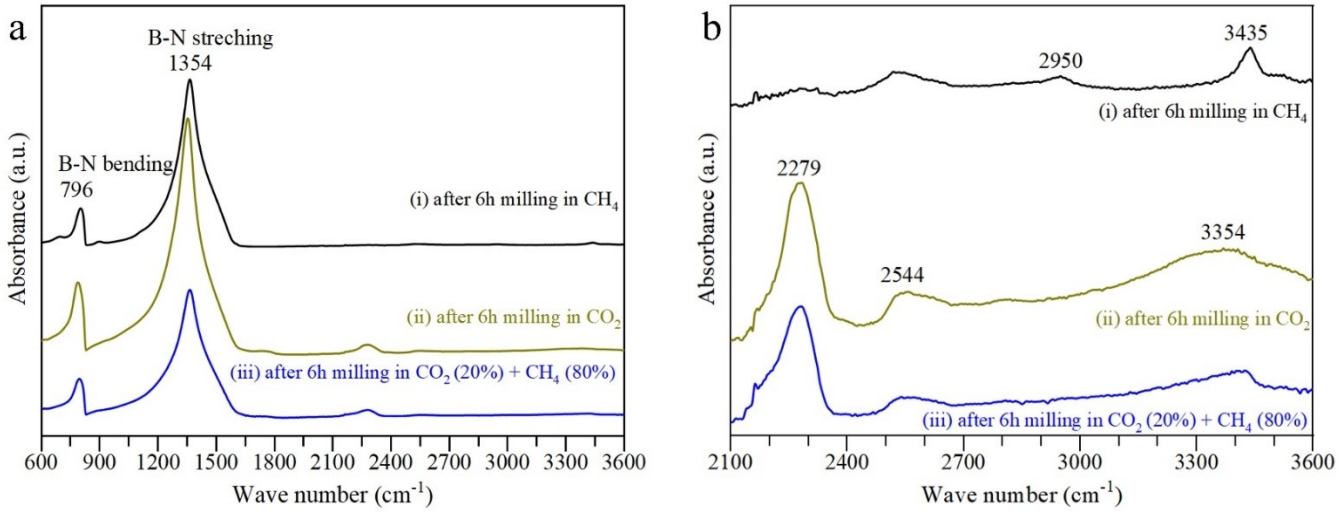

Figure S4: (a) FTIR spectra of the BN milled for 4 hours in CH_4 (i) and CO_2 (ii), and mixture gas of CO_2+CH_4 (iii). (b) Enlarged spectra of the same.

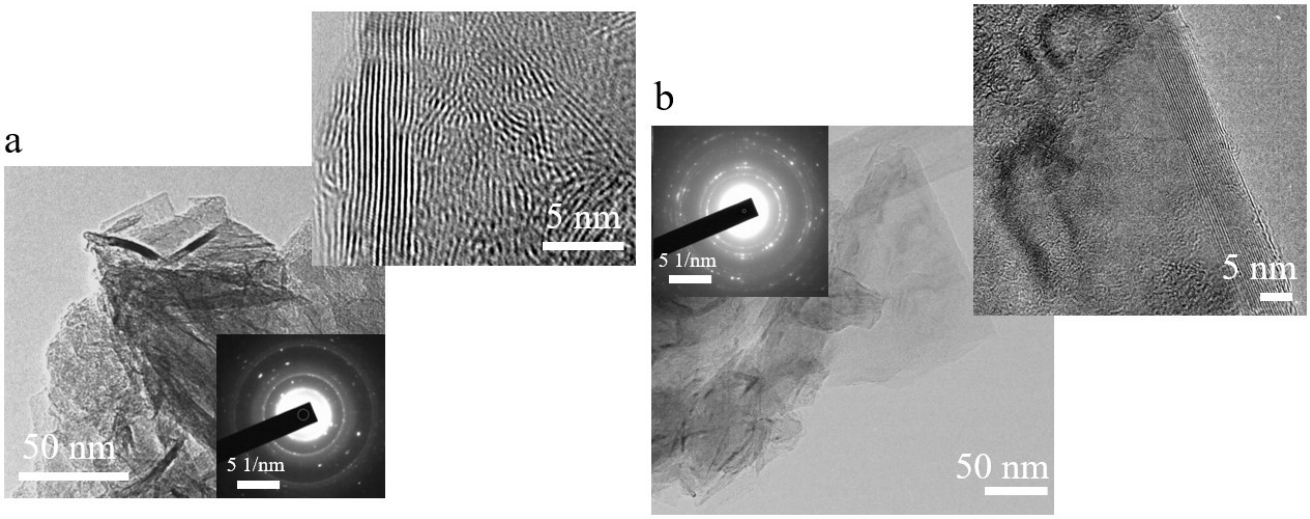

Figure S5: TEM images of the BN milled (for 6 hours) in a mixture gas of CO_2+CH_4 (a) and mixture gas of CO_2+N_2 (b); inset: SAED patterns.

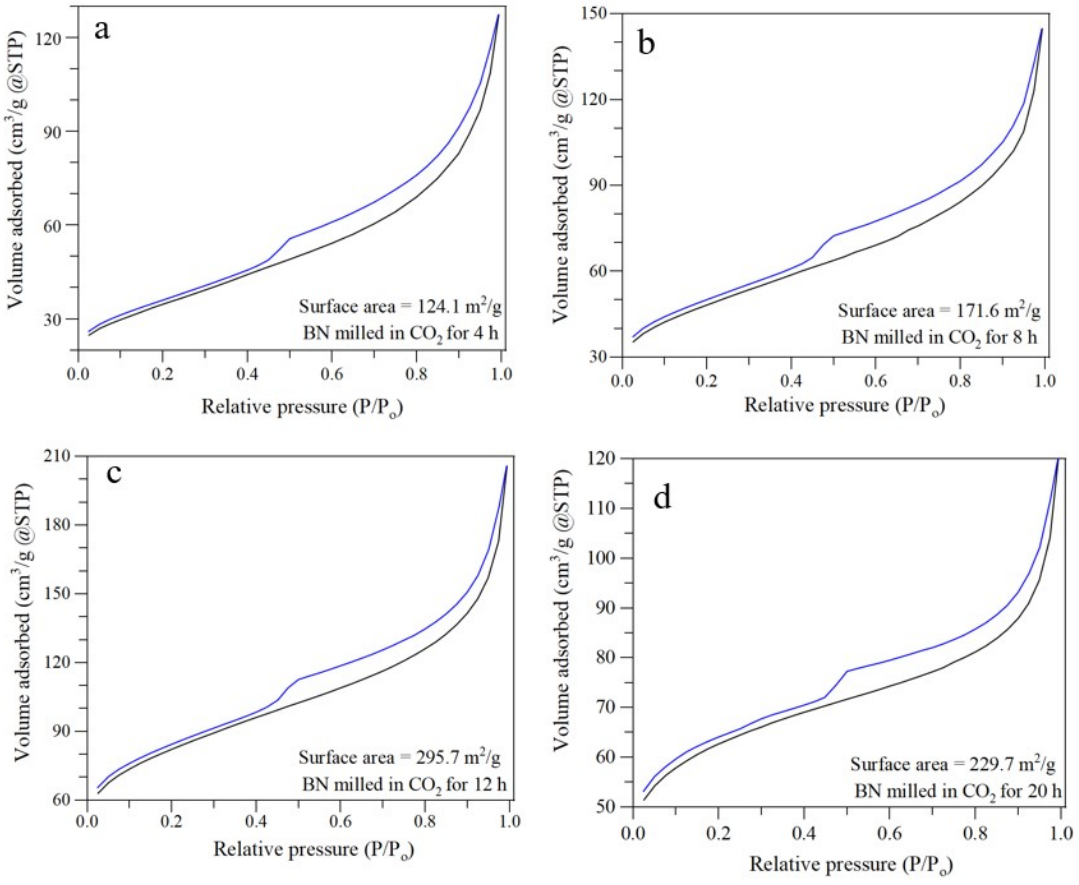

Figure S6: Nitrogen isotherms of BN milled in CO_2 for different time intervals, 4h (a) 8h (b); (c) 12h, 20h (d).

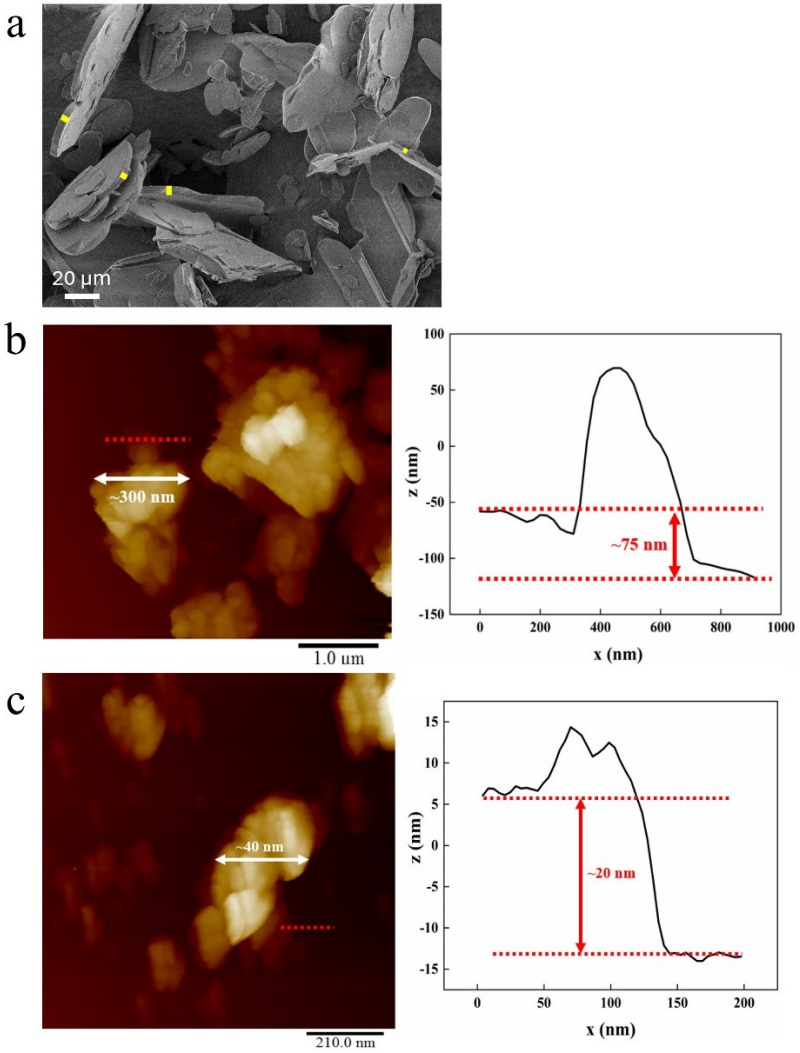

Figure S7: SEM image of bulk BN (a), AFM thickness analysis of BN milled in CO_2 for (b) 12h and (c) 20h.

The AFM analysis was conducted on BN milled in CO_2 for 12h and 20h. The starting bulk BN has lateral size and thickness of 35-60µm and 10-15µm respectively. After milling for 12h the thickness reduced to 75nm and for 20h milling it reduced to 20nm. At the same time, the reduction of lateral size was also observed. The lateral size was 300nm for 12 h milled then it reduced to 40nm for 20h milled BN. This confirms the formation of BN nanocrystallite structure to milling time.

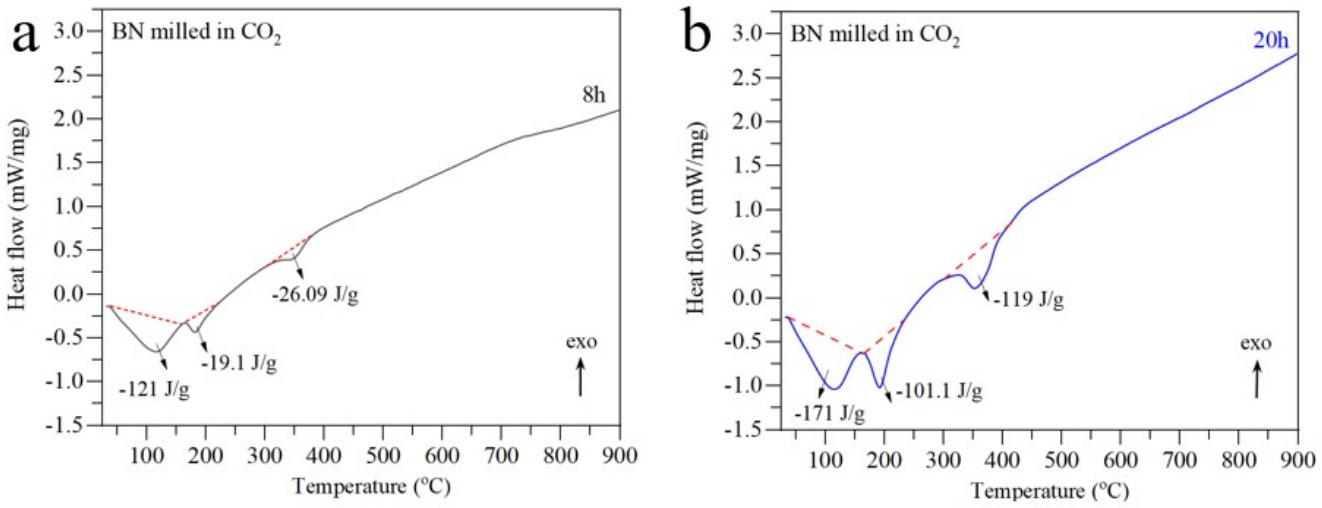

Figure S8: DSC heat flow curves of BN milled in CO_2 for 8h (a) and 20h (b).

Table S1: CO_2 uptake by different materials

Adsorbent	CO_2 uptake (mmol/g)	BET surface m^2/g	Selectivity	Reference
Boron Nitride	26.2	307.7		This work
Inorganic				
Novel $Li4SiO_4$-based sorbents containing $LiAlO_2$ and Li_2SiO_3	4.317	6.1	-	[1]
CeO_2 based sorbent	1.087	199	-	[2]
MgO based sorbents	2.27	2.71		[3]
Na_2CO_3-CaO	2.43	13.49	-	[4]
CaO particles into a 3D mesoporous silica (KIT-6) (CaK-2)	7.58	2.9	-	[5]
Organic				
Porous carbon xerogels hexamethylenetetramine (HTM)	2.89	963	-	[6]
MOF-200/GO	1.338	3359	18.37 (CO_2/CH_4)	[7]
PEI-purine-CNT	3.79	-	-	[8]
20PEI/CNT@NanoZ/Cd	5.7	403	-	[9]
Copper grafted, 3-aminopropyltriethoxysilane GO	8.10	-	-	[10]
2,4,6-Tris(bromomethyl) mesitylene, paraphenylenediamine, KOH activation	8.08	1033	19 (CO_2/CH_4)	[11]
Divinylbenzene, p-vinylbenzyl chloride, CCl4, KOH activation	6.88	1138	30.3 (CO_2/N_2)	[12]

Table S2:

Milling time (hr)	CO /N		CO /CH	
	% CO_2	% N_2	% CO_2	% CH_4
Before milling	20.00	80.00	20.00	80.00
After 2.5h milling	9.98	90.02	12.53	87.47
After 5h milling	0.44	99.56	7.17	92.83
After 5.5h milling	0	100		
After 6h milling			0	100

Supporting information References:

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