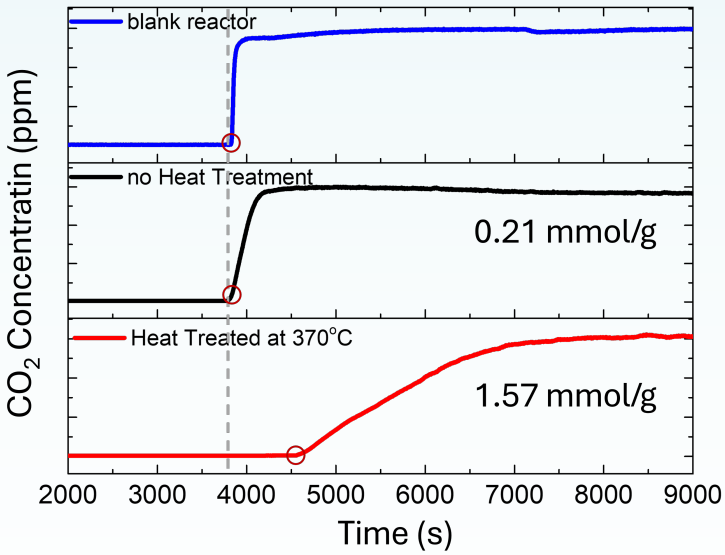
## Application Note 2:
## Effect of Pre-treatment on Dynamic $CO_2$ Breakthrough Curves and $CO_2$ adsorption capacity




Dynamic $CO_2$ Breakthrough Curves of blank reactor(blue), 13X zeolite without(black) and with (red) heat-treatment. Gray dashed-line exhibitst the gas switch from Ar to $CO_2$. The red circles on each curve indicate the points where the first $CO_2$ signal was detected by the NDIR Sensor.

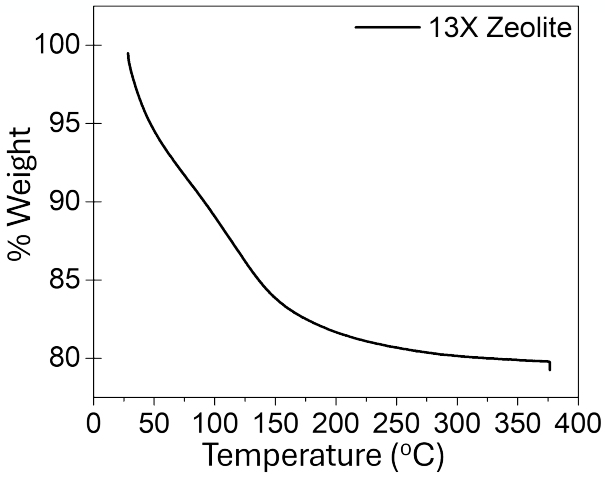
The time interval between the dashed line and the red circle, during which no $CO_2$ signal is detected, demonstrates the filling of the available pore volume of each porous sorbent material. This interval reflects the $CO_2$ adsorption capacity and efficiency of the different zeolite samples.

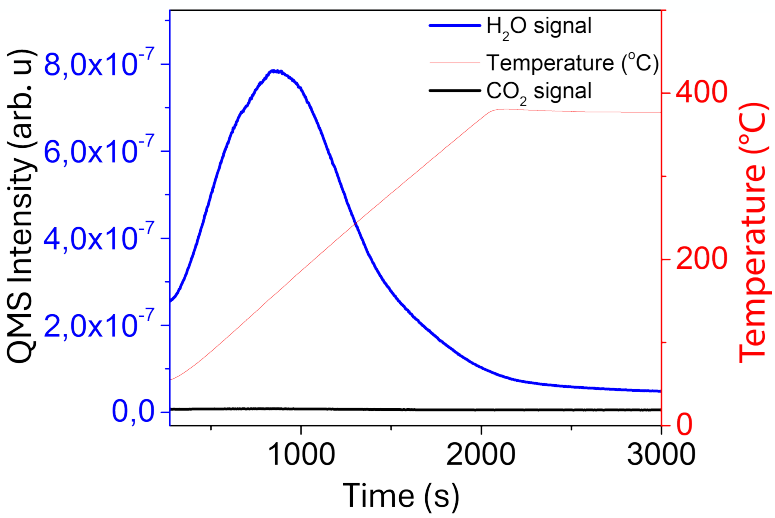
If no pre-treatment applied, all the pores and internal cages remain occupied by ambient water and other gases. Therefore, no rooms for $CO_2$ capture.

The delay between dashed line and red circle can be attributed to a larger pore volume, which allows more $CO_2$ to be adsorbed before it becomes detectable by the NDIR Sensor, and a stronger adsorption affinity, whereby $CO_2$ molecules are more effectively captured by the zeolite active sites.

SPECSON INSTRUMENTS

### Supporting Figure for water desorption during heat treatment.




(TG-MS results of 13X zeolite (a) % weight loss during heating under $N_2$ up to 400°C. (b) MS data recorded by Specson portable RGA 200 gas analyzer. Heating ramp is 10°C/min.)

One should always keep in mind the possible weight loss during heat treatment. In this specific example, 13X zeolite looses its 20% of initial weight. This is very important to calculate $CO_2$ capture capacity by unit mass.

Water desorption has started around 100°C, exhibited a peak maxima around 180°C, and continues around 20 min up to 370°C. Ease of outgassing depends on the sample nature.