



Surface Measurement Systems
World Leader in Sorption Science

BTA Frontier

Self-contained competitive sorption breakthrough analyzer

The BTA Frontier employs Breakthrough Analysis to measure competitive adsorption with flow capture, using a variety of gas, vapors, and sample types. This new instrument can employ single or multi-component adsorbate streams and test breakthrough times when passed along a packed sample column. This allows crucial sample properties and process-relevant key performance indicators to be determined. The BTA Frontier is a simple, self-contained Breakthrough analyzer, functional with or without a mass spectrometer, with multiple adsorbate sensors.



- Three different gas or vapor inlets/sources
- Generation of water vapor from 0-90%RH
- Sample, vapor & gas sources placed inside a temperature-controlled environment
- Small amounts of sample needed (~10 to 1000 mg)
- Vapor/gas sensors are located before & after sample column
 - CO₂
 - Water vapor
 - PID sensor- organic species: 1ppb to 100ppm
 - Thermal conductivity detector (TCD)
- In-situ sample regeneration up to 300 °C

A single component breakthrough curve

- Easy to measure capacity, both at equilibrium (t_e) & breakthrough (t_b)
- Kinetics of adsorption & mass transfer limitations: impact of flow rate, shaping, & packing
- In-situ drying/activation of sample up to 300 °C to gauge optimal activation temperature

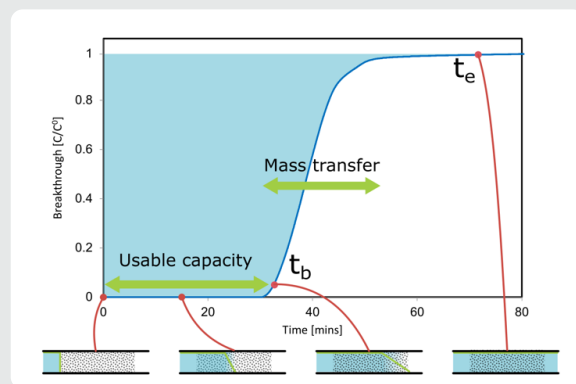


Figure 1: Breakthrough curve of water on Zeolite 13X at 25°C, highlighting how the adsorption front progresses through the column as a function of time

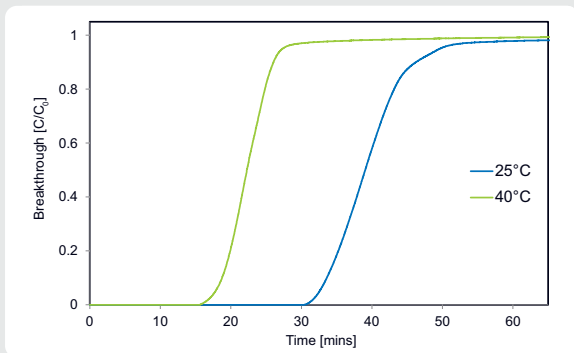


Figure 2: Influence of temperature on the breakthrough time of a 50% relative humidity stream on Zeolite 13X

Case study: The influence of temperature on breakthrough

- Accurately measure breakthrough time at a range of temperatures
- Available temperature range from 15-60 °C
- Determine time between breakthrough & equilibration

Case study: Impact of H₂O on CO₂ adsorption (20% RH and 3.5% vol CO₂)

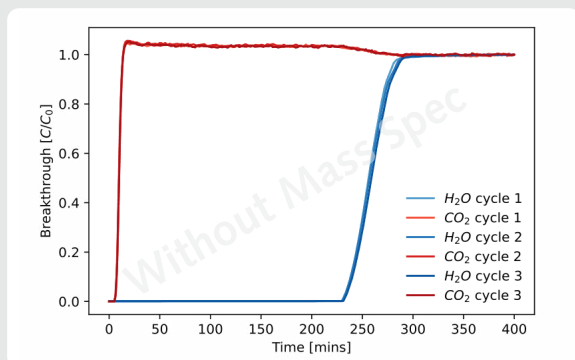


Figure 3: Three sequential CO₂/H₂O breakthrough experiments (activation not shown) on Zeolite 13X

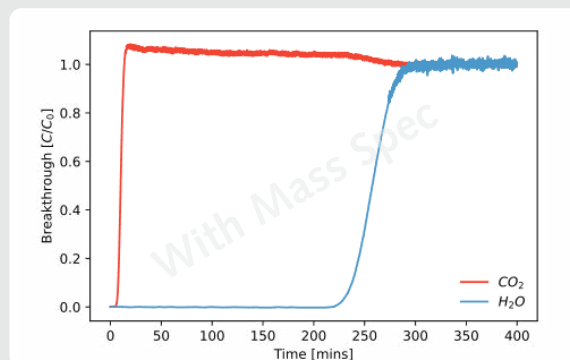


Figure 4: Same breakthrough experiment recorded using a mass spectrometer

- Explore the competitive effect of water on the CO₂ adsorption of porous materials
- Characteristic “roll-up” effect is observed, as the water front is replacing adsorbed CO₂
- Highly comparable results with (Fig 3) or without (Fig 4) mass spectrometer
- Near-perfect repeatability over three cycles

Capabilities

- Temperature: 15-60 °C +/- 0.2 °C
- Column oven temperature up to 300 °C
- Heated water/solvent reservoir of 50 ml capacity
- Automated dead volume minimization with column bypass & helium blank
- Varying column dimensions suitable for sample quantities from 10 mg to 1000 mg
- Dedicated inline sensors for measurement of water, CO₂, organics (multiple range PID), TCD
- Optional functions with mass spectrometer

Generation of gases & vapors:

- Mixing with resolution of 0.1 mL/min MFC
 - Water 0-90% RH at ambient conditions
 - ppm-level of organic solvents / VOCs*
 - Dead volume calculation with helium injection
- *With a precalibrated cylinder

System information:

- Instrument dimensions Width: 0.65 m (25.5")
Depth: 0.68 m (27") & Height: 0.8 m (31")
- Instrument weight: 85 kg

To inquire about the BTA Frontier, email us at:
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