

CO₂ adsorption into zeolite 13X with GASPRO

INTRODUCTION

The rising level of CO₂ in atmosphere has been linked to global warming. To mitigate the global warming, R&D is being directed towards understanding the relevant phenomena and foster innovation in the field of CO₂ capture and sequestration (CCS). Due to their well-controlled pore structure and size, zeolites have been primary candidates in the gas separation (e.g. CO₂ capture) in industry. Knowledge about the CO₂ sorption properties of zeolites (adsorption capacity, pressure regimes and kinetics) is essential to the design of advanced materials capable of capturing CO₂ in industrial settings. Among zeolites, 13X is known for its relatively high CO₂ capacity. This application note highlights precision measurements of the absorptive properties of a zeolite 13X over a wide range of temperatures.

EXPERIMENT

CO₂ adsorption into zeolite 13X was measured at various temperatures using a GASPRO Sievert's apparatus which was developed to study sorption of a variety of gases from vacuum up to 200 bar and from liquid He to 500 °C. Temperatures. Gas density temperature correction were done by measuring the apparent free gas volume at temperature.

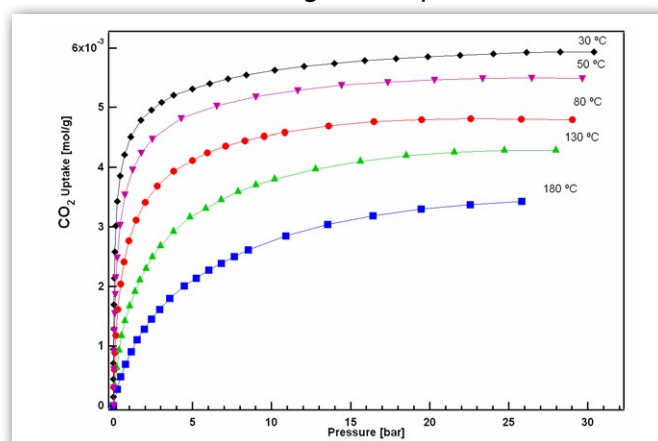


Figure 1. PCT- isotherms for zeolite 13X at 30, 50, 80, 120 and 180 °C

RESULTS AND CONCLUSION


The PCT isotherms for CO₂ adsorption into zeolite 13X are shown in Figure 2. The zeolite capacity decreases with temperature reflecting the physisorption nature of the adsorption isotherms. The data are in good agreement with literature. For example, the CO₂ capacity at 30 °C 20 bar is 5.7 moles/kg (5.0-6.4 moles/kg in the literature). The GASPRO is well-suited for the detailed characterization of materials used in CCS (adsorption of CO₂ onto different solid sorbents). The ease of use and the temperature and pressure range are ideal for this type of materials application.

Reference: R Siriwardane, M Shen, E Fisher, et al. NETL report, www.netl.doe.gov

INSTRUMENT

GASPRO

-260°C to 500°C



- **WIDE TEMPERATURE RANGE ENABLING A VARIETY OF APPLICATIONS**
from sub-ambient operations up to 500+ °C with a customized solution
- **VARIETY OF MODES OF OPERATION**
ability to combine PCT, kinetics and cycle-life modes to 200 bar to determine the quantity and rate of sample/gas interaction and its ageing characteristics all in one instrument and operation
- **HIGH ACCURACY**
to reduce cumulative error across multiple measurements points
- **PRECISION MEASUREMENT OF SMALL SAMPLES**
using the patented microdoser option (US8132476)
- **EXTERNAL CALORIMETER COUPLING CAPABILITY**