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.

INTRODUCTION

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.

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.


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