CO_2 adsorption into zeolite 13X with PCTPro

Introduction:

The rising level of CO_2 in atmosphere has been linked to global warming, threatening life as we know it. To mitigate the global warming, R&D is being directed towards understanding the relevant phenomena and foster innovation in the field of CO_2 capture and sequestration (CCS). Due to their well-controlled pore structure and size, zeolites have been primary candidates in the gas separation (e.g. CO_2 capture) in industry. Knowledge about the CO_2 sorption properties of zeolites (adsorption capacity, pressure regimes and kinetics) is essential to the design of advanced materials capable of capturing CO_2 in industrial settings. Among zeolites, 13X is known for its relatively high CO_2 capacity. This application note highlights precision measurements of the absorptive properties of a zeolite 13X over a wide range of temperatures.

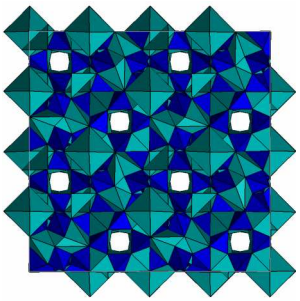

Figure 1. Structure of a type X zeolite

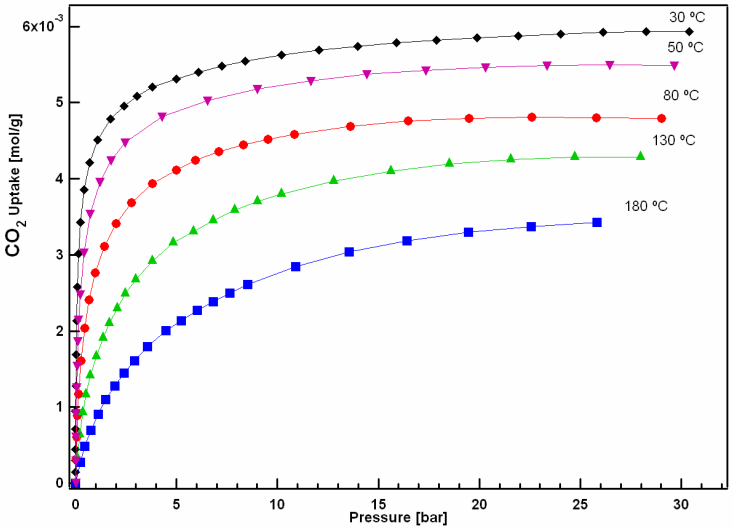

Figure 2. PCT- isothermes for zeolite 13X at 30, 50, 80, 120 and 180 ℃

Experimental

CO_2 adsorption into zeolite 13X was measurec various temperatures using a PCTPro E Sievert's apparatus which was developed study sorption of a variety of gases from vacu 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 discussion

The PCT isotherms for CO_2 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 CO_2 capacity at 30 °C 20 bar is 5.7 moles/kg (5.0-6.4 moles/kg in the literature). The PCTPro E&E is well-suited for the detailed characterization of materials used in CCS (adsorption of CO_2 onto different solid sorbents). The ease of use and the temperature and pressure range are ideal for this type of materials application.

PCTPro-E&E Sievert's apparatus

Literature

1. D Bonenfant, M Kharoune, P Niquette et al. Sci. Technol. Adv. Mater. 9 (2008) 013007

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