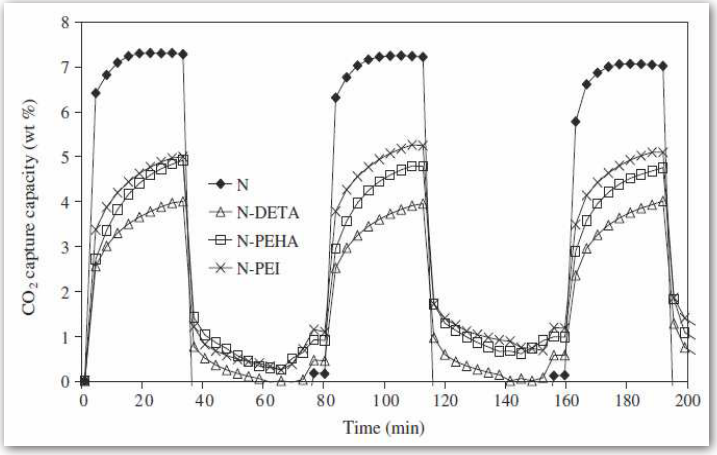
CO_2 capture on aminated solid sorbents by thermogravimetry

INTRODUCTION

The leading contender for post-combustion carbon dioxide capture from coal-fired power plants is the use of amine solvents. Despite the advantages of solvent scrubbing, there are several disadvantages, especially the thermal efficiency losses due to the energy needed to regenerate the solvent by driving off the captured CO_2. The use of solid sorbents impregnated with different amine solutions provides a new technological approach for CO_2 capture with the absorption capacity of amines and the easy handling of solids without corrosion drawback. Thermogravimetry is very well adapted to investigate the adsorption and desorption performances of the samples and define the CO_2 capture capacity of the corresponding aminated solid sorbents.



EXPERIMENT

THEMYS TGA can be used for the investigation of the aminated solid sorbents (1). Commercial activated carbon Norit CGP Super (called N) is selected as the raw material. N is impregnated with different amine compounds: diethylentriamine (DETA), pentaethylenehexamine (PEHA) and polyethylenimine (PEI). Isothermal CO_2 capture tests are run at 25 °C according to the Vacuum Swing Adsorption (VSA) technique. Each cycle includes a 30 min CO_2 capture step followed by regeneration under vacuum for 30 min, and normal pressure recovery with an inert gas. The mass increase during the capture step is interpreted as the CO_2 adsorption capacity of the solid sorbents.

RESULTS AND CONCLUSION

While N reaches the plateau of maximum capture capacity in 20 min, the impregnated samples present a continual upward tendency for the 30 min of the capture step and attain no equilibrium capacity. Impregnation slows down the kinetics of the capture process, due to the diffusion of gaseous CO_2 through the amine film. The CO_2 capture capacities are also decreased after cycles 2 and 3. Impregnation with amines reduces the microporous volume of the activated carbon, thereby decreasing the capture capacity at room temperature.

1- M.G. Plaza, C. Pevida, A. Arenillas, F. Rubiera, J.J. Pis, Fuel 86 (2007) 2204–2212

INSTRUMENT

THEMYS TGA

HIGH ACCURACY & VERSATILITY
hang-down symmetrical beam balance, specifically designed for TGA applications

ULTRA-HIGH TEMPERATURE CAPABILITY
to 2400°C with a single furnace.

MODULAR ADAPTIONS ALLOWING
TGA only, DTA only, TG-DTA, and TMA up to 2400°C, DSC only and TG-DSC up to 1600°C all in one instrument.

EXTERNAL COUPLING CAPABILITY
designed for evolved gas analyzers (FTIR, MS, GCMS, MSFTIR, or FTIR-GCMS)