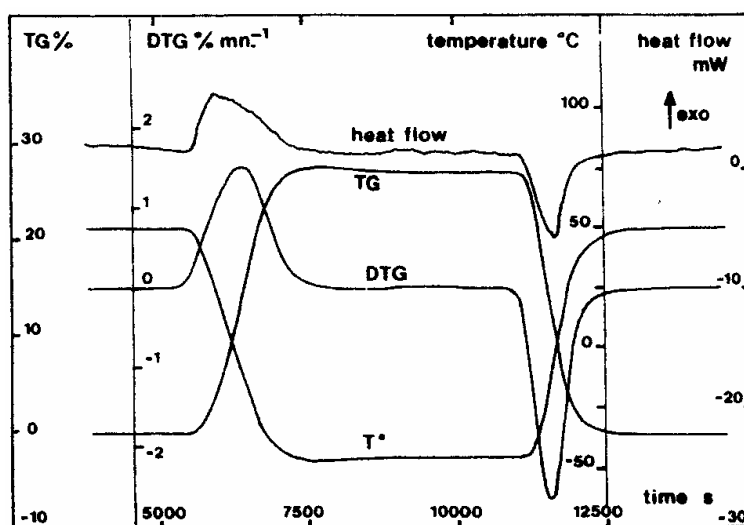


Adsorption and desorption of CO₂ on active coal

Introduction: Capture of carbon dioxide from fossil fuel power plants via adsorption and sequestration of carbon dioxide in unmineable coal seams are achievable near-term methods of the reducing atmospheric emissions of this greenhouse gas. The evaluation of CO₂ adsorption and desorption characteristics on finely crushed and uncrushed samples is critical for CO₂ sequestration in coal beds.

The TG-DSC technique is the ideal tool for such investigations:

- the thermogravimetric signal provides the amount of CO₂ adsorbed or desorbed on the coal sample
- the DSC signal measures the corresponding enthalpy: exothermic during adsorption (that means an increase of the temperature during the sequestration process) or endothermic during the desorption (that means cooling of the coal material)



Experimental

Sample: active coal

Mass: 29.1 mg

Temperature range: -50°C to 50°C

Atmosphere: CO₂

Results (...)

With such a TG-DSC experiment, it is possible to determine the corresponding enthalpies of adsorption or desorption versus the amount of CO₂ adsorbed or desorbed on the sample

Results

The sample of active coal is cooled down from 50°C to -50°C, then maintained at -50°C during more than one hour before reheated at 50°C under pure CO₂.

The TG curve shows the mass increase of the sample corresponding to the CO₂ adsorption. The saturation of the sample is obtained during the isothermal step at -50°C.

When heating the mass loss on the TG curve indicates the CO₂ desorption. It is noticed that the desorption is not complete.

The DTG curves give an information on the rate of CO₂ adsorption and desorption.

On the DSC curve, the CO₂ adsorption corresponds to an exothermic effect and the desorption to an endothermic effect.

Instrument :
SENSYS TG-DSC_{evo}
 (-120 to 830°C)



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