Thermal, Oxidative and CO_2–induced Degradation of Supported Polyethylenimine Adsorbents

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Supporting information

Adsorption Set-up and Procedure for Gravimetric Measurements

Adsorption measurements were carried out gravimetrically using a Rubotherm magnetic suspension balance. A schematic diagram of the set-up including a gas humidifier is shown in Figure S1. It consists of a crucible suspended to a permanent magnet, which is kept in a suspension state by an electromagnet, a network of pipes, shut-off valves, control valves, mass flow controllers, pressure and temperature sensors and a gas humidifier. The electromagnet is hanged by the hook of a microbalance and transmits the suspension force without contact from the pressurized measuring cell to the balance at ambient atmosphere. The position of the permanent magnet is regulated and kept constant using a controlling system. The suspension force transmitted to the microbalance is commensurate to the weight of the crucible-adsorbent-adsorbed phase system.

Adsorption Measurements: In a typical experiment, the adsorbent was weighed and placed in the crucible. The suspended crucible-adsorbent and the permanent magnet were situated in a closed vessel in which the required pressure and temperature were applied. The adsorbent was pretreated at a given temperature for a specific time. Then, the sample was cooled to the adsorption temperature and exposed to adsorbate-containing gas at a constant flow rate for a period of time. The gas was then switched to the regenerating gas and the sample heated to the

desorption temperature. This adsorption-desorption cycle was repeated. The flow rate, pressure, temperature, and the adsorbed mass were measured at regular intervals.

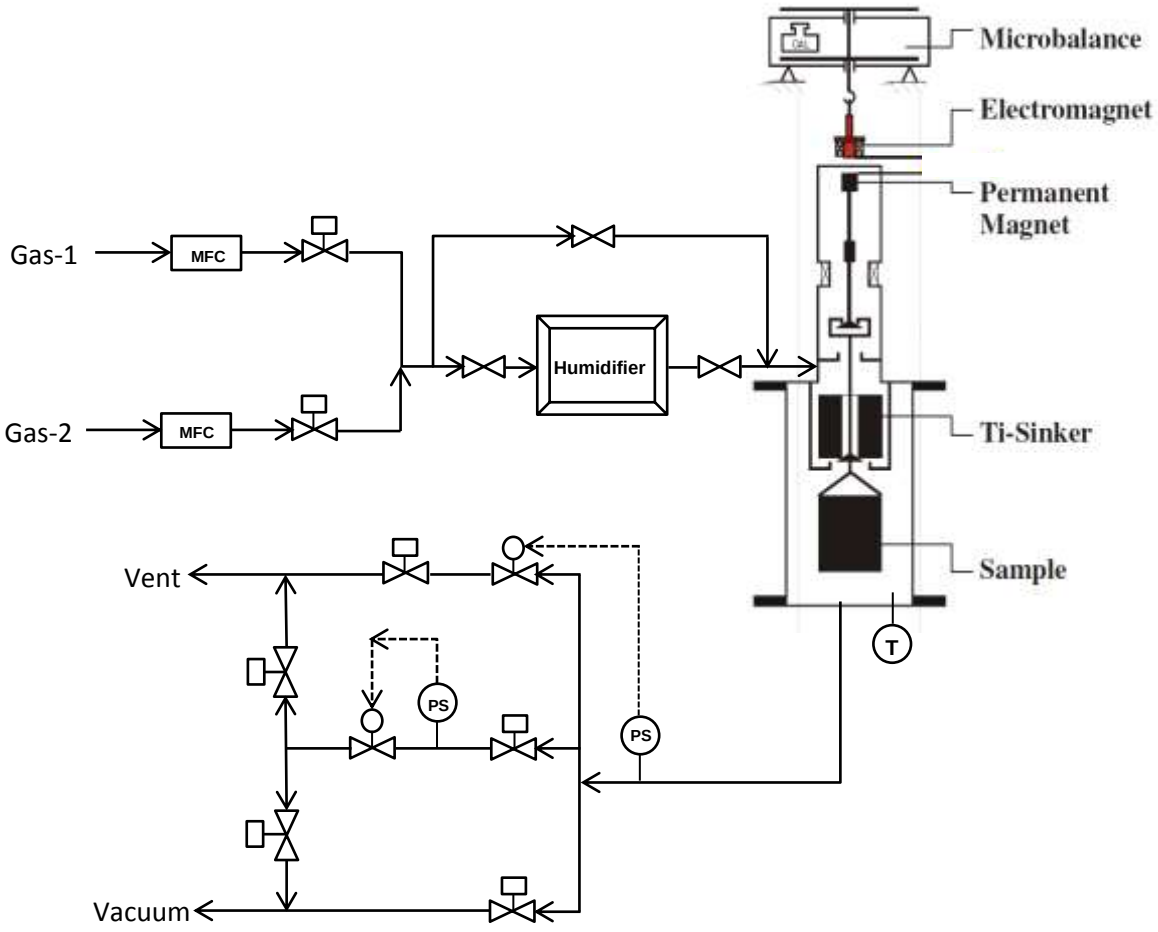

Figure S1. Schematic diagram of the Rubotherm gravimetric set-up

Calculation: The data which are recorded in the adsorption measurement are the apparent mass (M_{meas}), the temperature (T), the pressure (p) and the time (t). The density of the gas can be calculated using an appropriate equation of state. The recorded mass (M_{meas}) during the measurement should be corrected for the buoyancy effect acting on the sample and the crucible.

$$M_{corr} = M_{meas} + \rho_{gas}(p,T).V_{ads+cr}$$

Here, M_{meas} is the measured mass of the system (adsorbent- crucible- adsorbed phase), M_{corr} is the real mass of the system, $\rho_{gas}(p,T)$ is the density of the gas, and V_{ads+cr} is the volume of the adsorbent and the crucible.

The buoyancy corrected mass (M_{corr}) is the mass of both sample and crucible. The mass of adsorbent including the adsorbed gas is calculated as follows:

$$M_{ads+ads.gas} = M_{corr} - M_{cr}$$

where, M_{cr} is the mass of the empty crucible.

Finally, by subtracting of $M_{ads+ads.gas}$ from the mass of adsorbent (M_{ads}), the mass change, i.e. the mass of adsorbed gas is determined.