

Electronic Supporting Information (ESI)

Synthesis of Magnesium Oxide Nanoparticles Fabricated on Graphene Oxide Nanocomposite for CO₂ Sequestration at Elevated Temperatures

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Characterization.

Nitrogen adsorption isotherms were measured at -196 °C on an ASAP 2010 volumetric analyzer (Micromeritics, Inc., Norcross, GA). Prior to adsorption measurements, all samples were outgassed under vacuum at 110 °C for 2 hours.

High resolution thermogravimetric measurements were recorded on TGA Q-500 analyzer (TA Instruments, Inc., New Castle, DE). Thermogravimetric (TG) profiles were recorded from 25 °C to 700 °C in flowing nitrogen with a heating rate of 10 °C / min using a high resolution mode. The weight of each analyzed sample was typically in 5-20 mg range. The TG profiles were used to obtain information about the extent of the template removal.

Room temperature CO₂ adsorption measurements (Physisorption). CO₂ adsorption on the selected MONP & MONP-GO materials was measured in the pressure range up to 1 atm on ASAP 2020 volumetric adsorption analyzer (Micromeritics, Inc., GA) at 25 °C using ultrahigh purity (99.99 %) gaseous CO₂. Prior to adsorption analysis each sample was outgassed at 110 °C for 2 h under vacuum.

CO₂ chemisorption and TPD measurements.

CO₂ chemisorption and TPD experiments were conducted using a Micromeritics Auto Chem II Chemisorption Analyzer (Micromeritics, Inc., GA) equipped with a thermocouple detector (TCD). Approximately 50-100 mg of each sample were loaded in a quartz tube microreactor supported by quartz wool and subjected to pre-treatment by ramping temperature from 25 to 490 °C before CO₂ adsorption, using a heating rate of 10 °C/min in flowing helium (at a rate of 50 cm³/min) and kept for 10 min at 490 °C. Next, the sample was cooled to selected temperature (120 /60 °C) using cooling rate of 10 °C/min, exposed to pulse of 5 % CO₂-He (50 cm³/min) as a loop gas, kept for 3 minutes and allowed for return to baseline. Recording was repeated until peaks are equal or 30 times. Recording was taken every 0.1 seconds and finally post CO₂ pulse purge was applied in

flowing helium (50 cm³/min) for 30 min. In the TPD experiments, the samples were heated up to 490 °C using a heating rate of 5 °C/min and kept at this temperature for 90 min. The amounts of desorbed CO₂ were obtained by integration of the desorption profiles and referenced to the TCD signals calibrated for known volumes of analyzed gases.

Calculations.

The Brunauer-Emmett-Teller specific surface areas (S_{BET}) were calculated from the N₂ adsorption isotherms in the relative pressure range of 0.05-0.2 using a cross sectional area of 0.162 nm² per nitrogen molecule. The single-point pore volume (V_{sp}) was estimated from the amount adsorbed at a relative pressure (p/p^0) of ~ 0.98. The pore width (W_{max}) was obtained at the maximum of the PSD curve.