Electronic Supplementary Material (ESI) for Sustainable Energy & Fuels.

Supplementary Material

Novel Aqueous Amine Looping Approach for the Direct Capture, Conversion and Storage of CO_2 to Produce Magnesium Carbonate

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The contents of the supporting information are listed below.

Table S1. The extents of carbon mineralization of MgO as a function of MEA concentrations and temperatures.

Temperature	H_2O	10 wt% MEA	20 wt% MEA	30 wt% MEA	50 wt% MEA
25 ^oC	8.1	2.1	1.6	1.5	4.2
50 ^oC	18.1	32.7	46.9	70.2	12.2
75 ^oC	42.0	46.3	52.4	62.2	52.7
90 ^oC	27.8	32.4	37.5	35.6	24.2

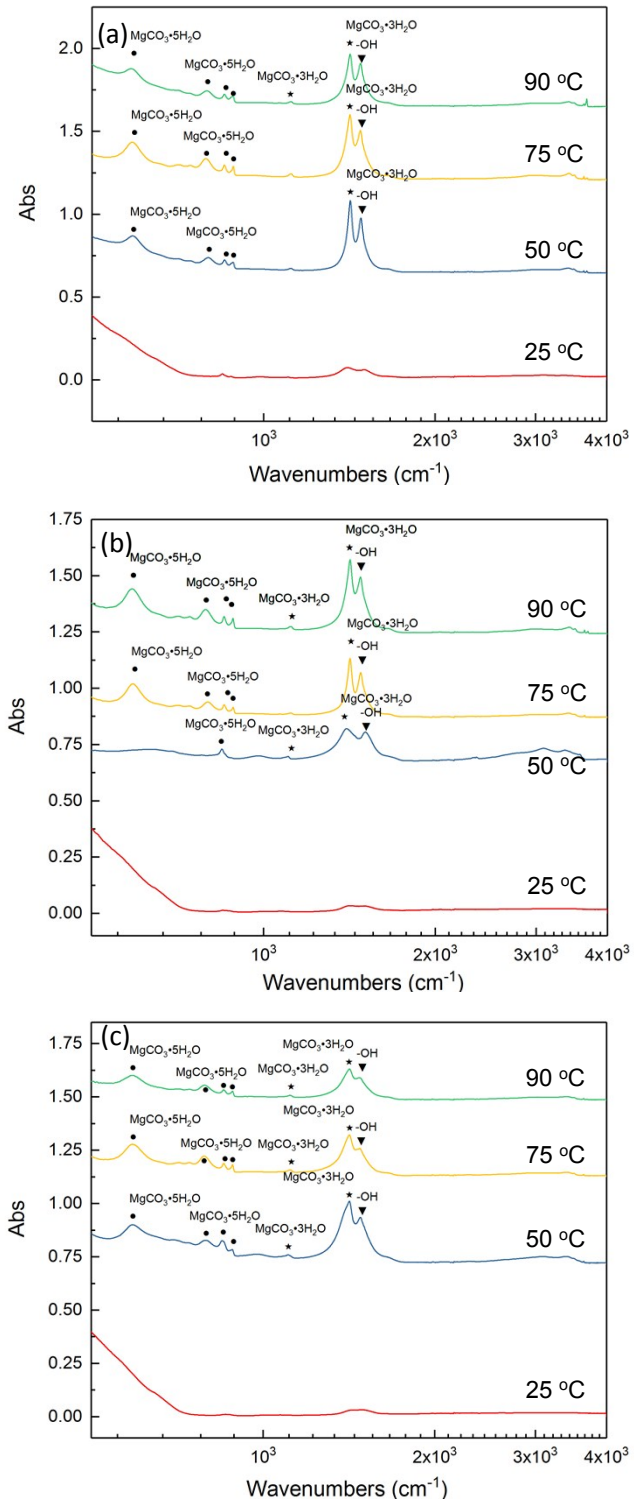

Figure S1. Identification of the functional groups present in the solid obtained after reacting MgO with water (a), 10 wt% (b), and 20 wt% MEA (c) at 25 °C, 50 °C, 75 °C, and 90 °C with $P_{CO_2} =$ 1 atm for 3 hours and stirring rate of 300 rpm $\pm$ 5 rpm, using ATR-FTIR measurements.

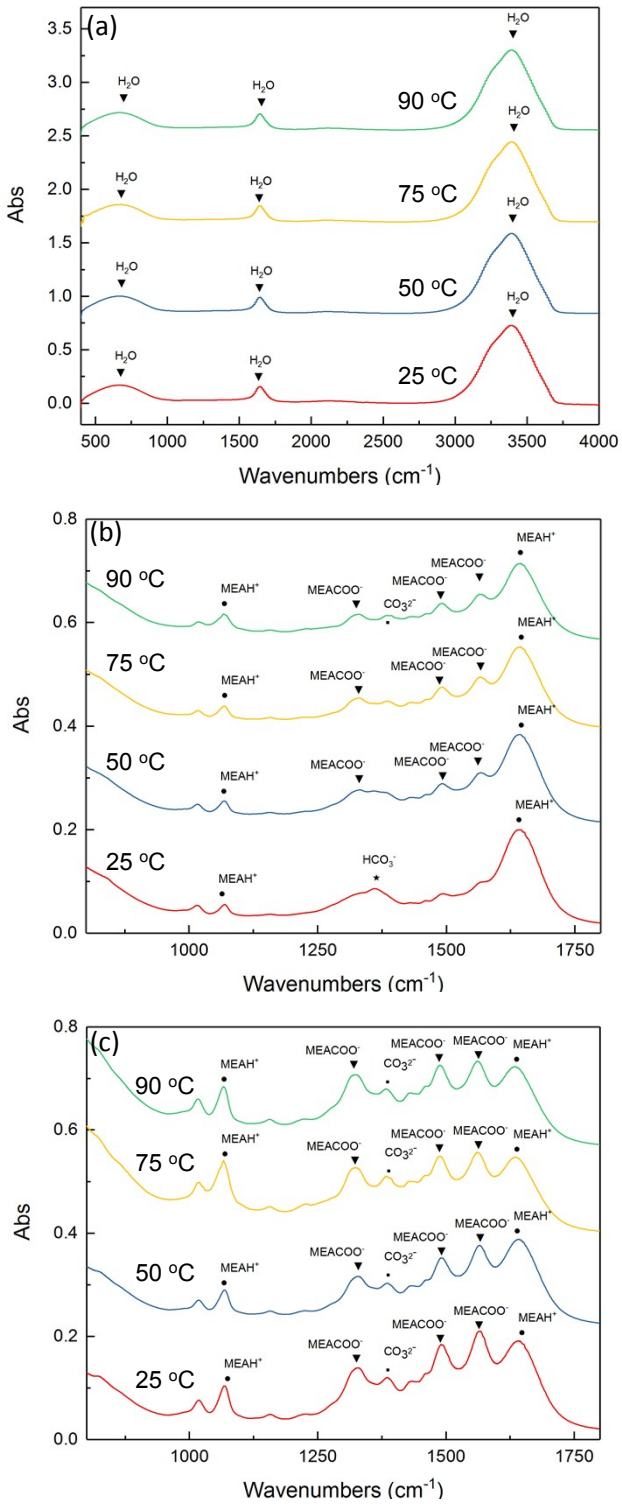

Figure S2. Identification of the functional groups present in the fluid obtained from reacting MgO with water (a), 10 wt% (b), and 20 wt% at 25 °C, 50 °C, 75 °C, and 90 °C with $P_{CO_2} =$ 1 atm for 3 hours and stirring rate of 300 rpm $\pm$ 5 rpm, using ATR-FTIR measurements.

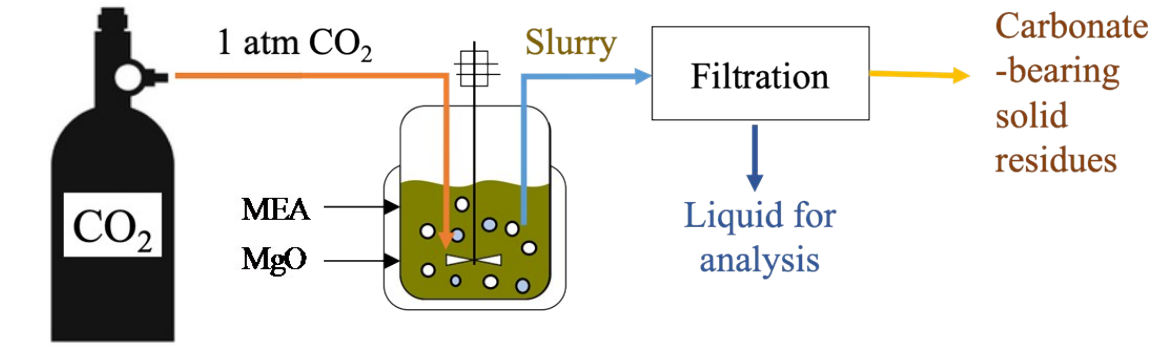

Figure S3. Experimental configuration of aqueous alkaline amine looping process for accelerated carbon mineralization.

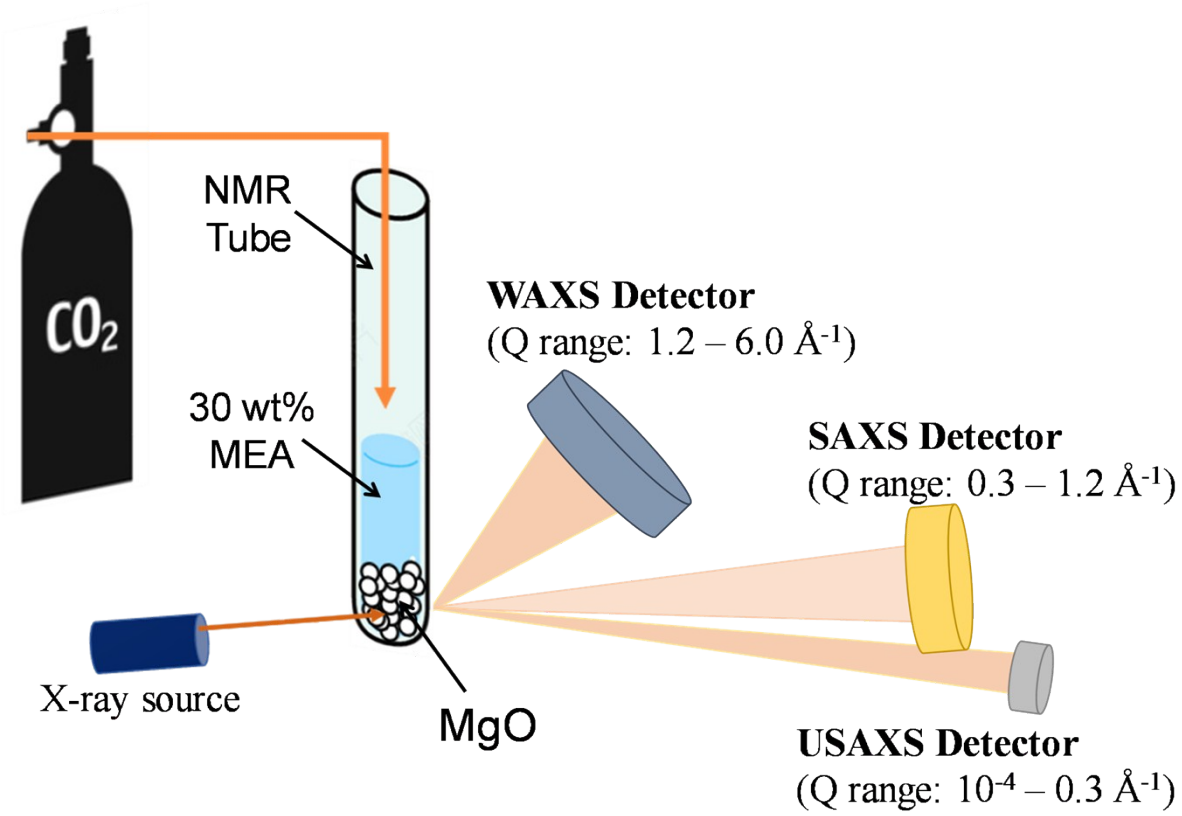

Figure S4. Experimental configuration of MgO reacting with CO_2-loaded MEA in the USAXS/SAXS measurement.

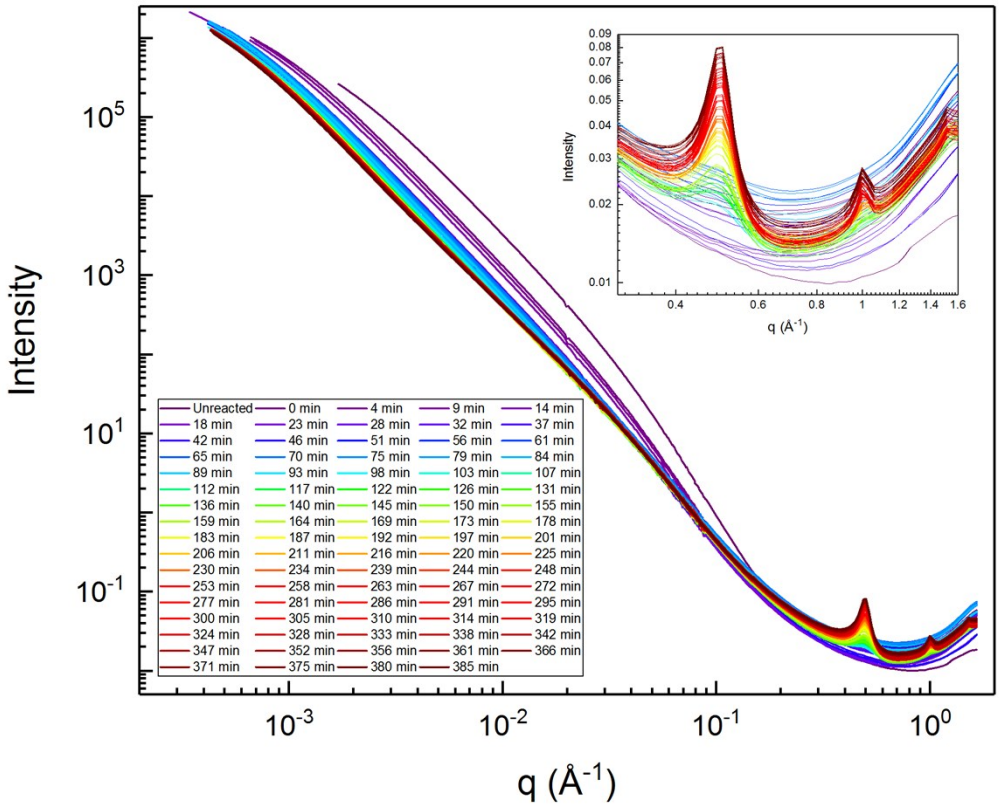

Figure S5. Changes in the combined slit-smeared USAXS/SAXS data as MgO is reacted with CO_2-loaded MEA to produce magnesium carbonate (full set of data).

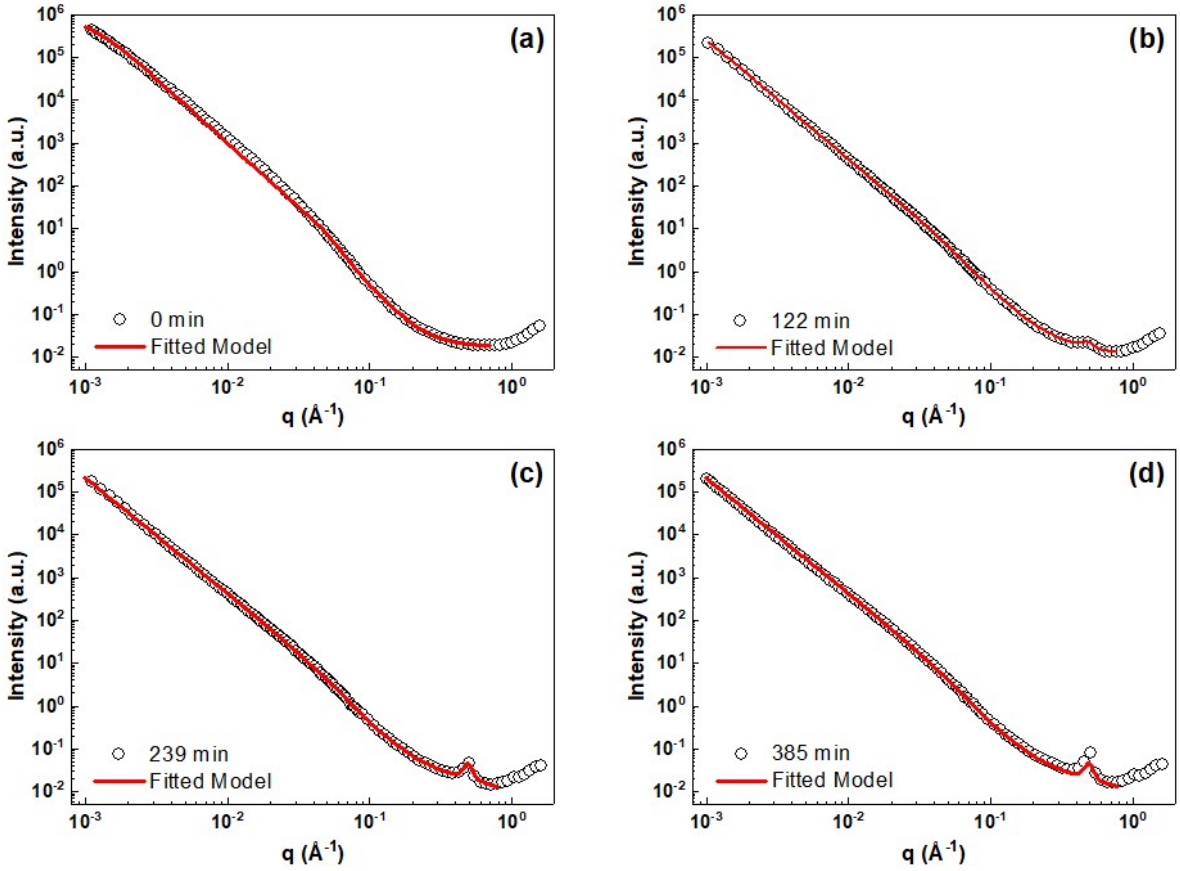

Figure S6. Experimental USAXS/SAXS scattering curves and fitted models for samples reacted for (a) 0 min, (b) 122 min, (c) 239 min, and (d) 385 min. The data were fitted using the Modelling -II tool in Irena package embedded in Igor Pro. The curve in (a) was modeled using two unified fit levels between the *q*-ranges of 0.001 - 0.02 $Å^{-1}$ and 0.02 - 0.8 $Å^{-1}$. For curves in panels (b), (c) and (d) besides two unified fit levels in *q*-ranges of 0.001 - 0.02 $Å^{-1}$ and 0.02 - 0.3 $Å^{-1}$, a Lorentzian diffraction peak was also fitted between *q* values of 0.3 - 0.8 $Å^{-1}$.