Electronic Supplemental Information for:

Dolomite: A Low Cost Thermochemical Energy Storage Material

Terry D. Humphries,[a] Kasper T. Møller,[a] William D. A. Rickard,[b] M. Veronica Sofianos,[a] Shaomin Liu,[c] Craig E. Buckley,[a] Mark Paskevicius[a]*

a. Department of Physics and Astronomy, Fuels and Energy Technology Institute, Curtin University, GPO Box U1987, Perth, WA 6845, Australia
b. John De Laeter Centre, Curtin University, GPO Box U1987, Perth, WA 6845, Australia
c. Department of Chemical Engineering, Curtin University, Perth, 6102, Western Australia, Australia

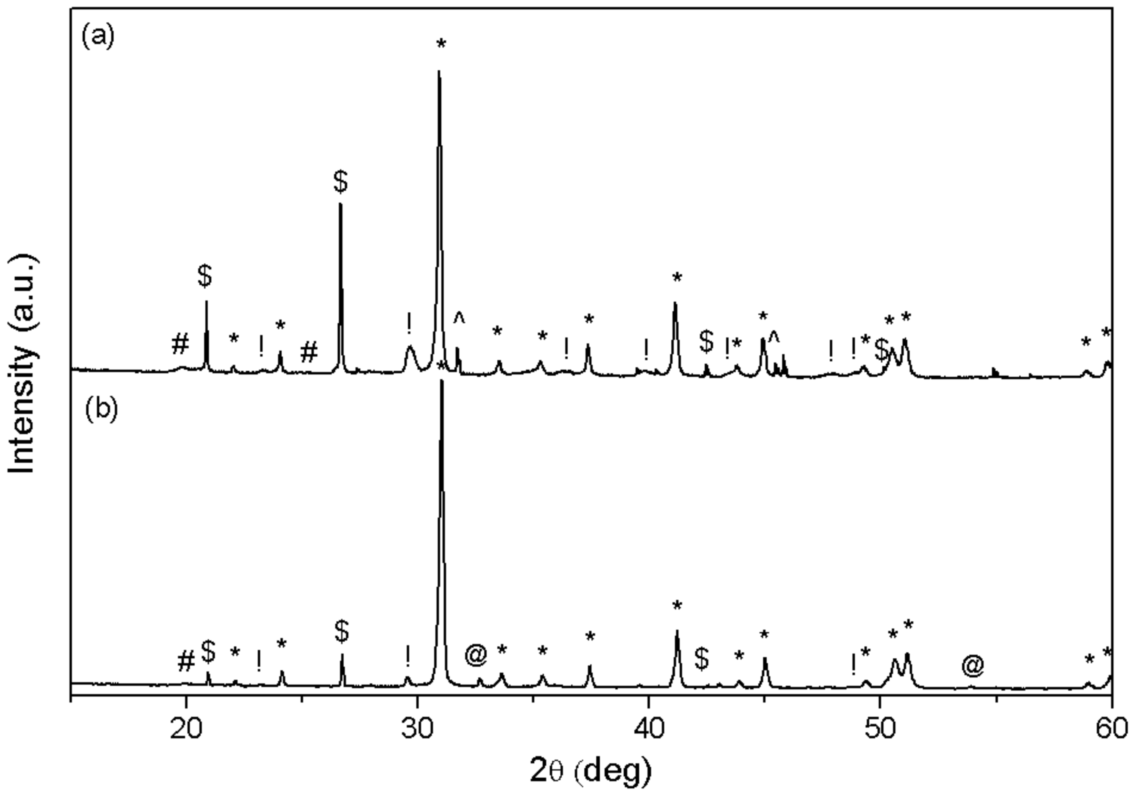

Figure S1. XRD analysis of (a) as supplied Richgro dolomite (Rich-A) and (b) Watheroo dolomite (Wath-A). * = dolomite, ! = calcite, $ = quartz, # = andradite, ^ = NaCl, @ = magnesite. λ = CuK$\alpha_{1,2}$.

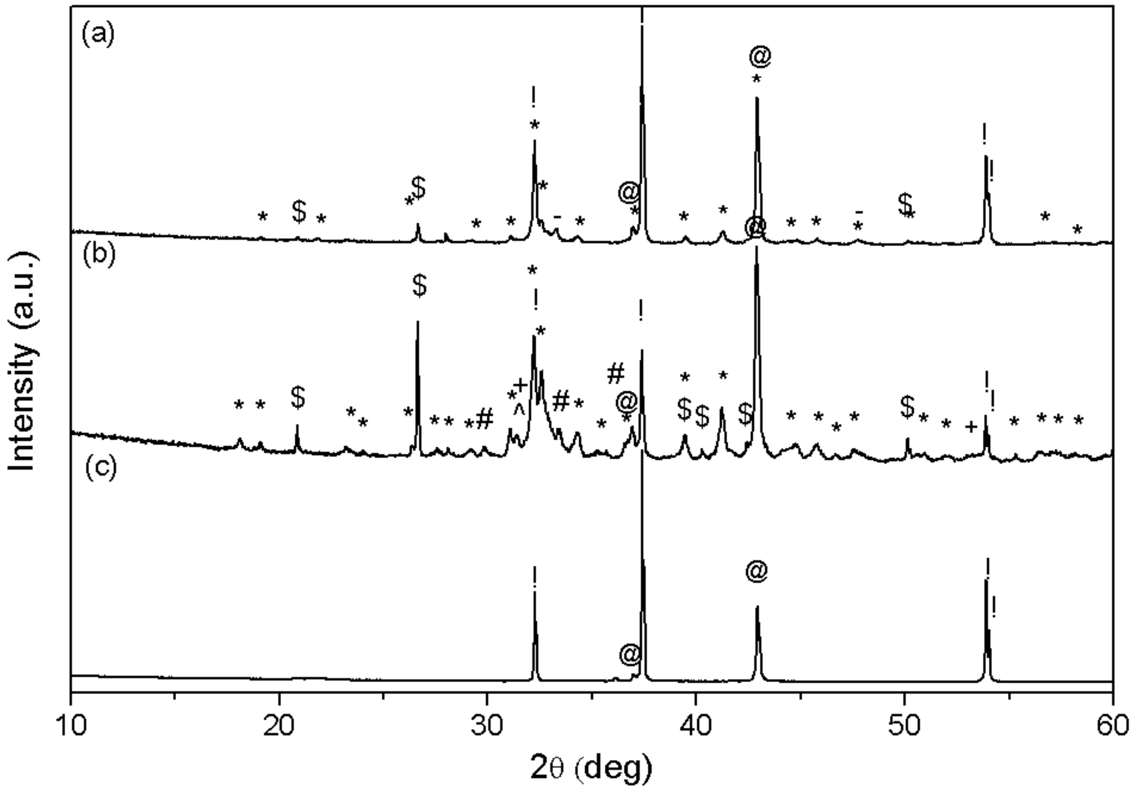

Figure S2. XRD analysis of thermally outgassed (a) Watheroo dolomite at 1000 °C (Wath-B), (b) Richgro dolomite at 1000 °C (Rich-B) and (c) synthetic dolomite at 650 °C (Synth-B). ! = CaO, @ = MgO, $ = quartz, * = larnite, - = $Ca_9(Al_2O_6)_3$, ^ = NaCl, # = andradite, + = gehlenite. Flowing Ar. λ = $CuK\alpha_{1,2}$.

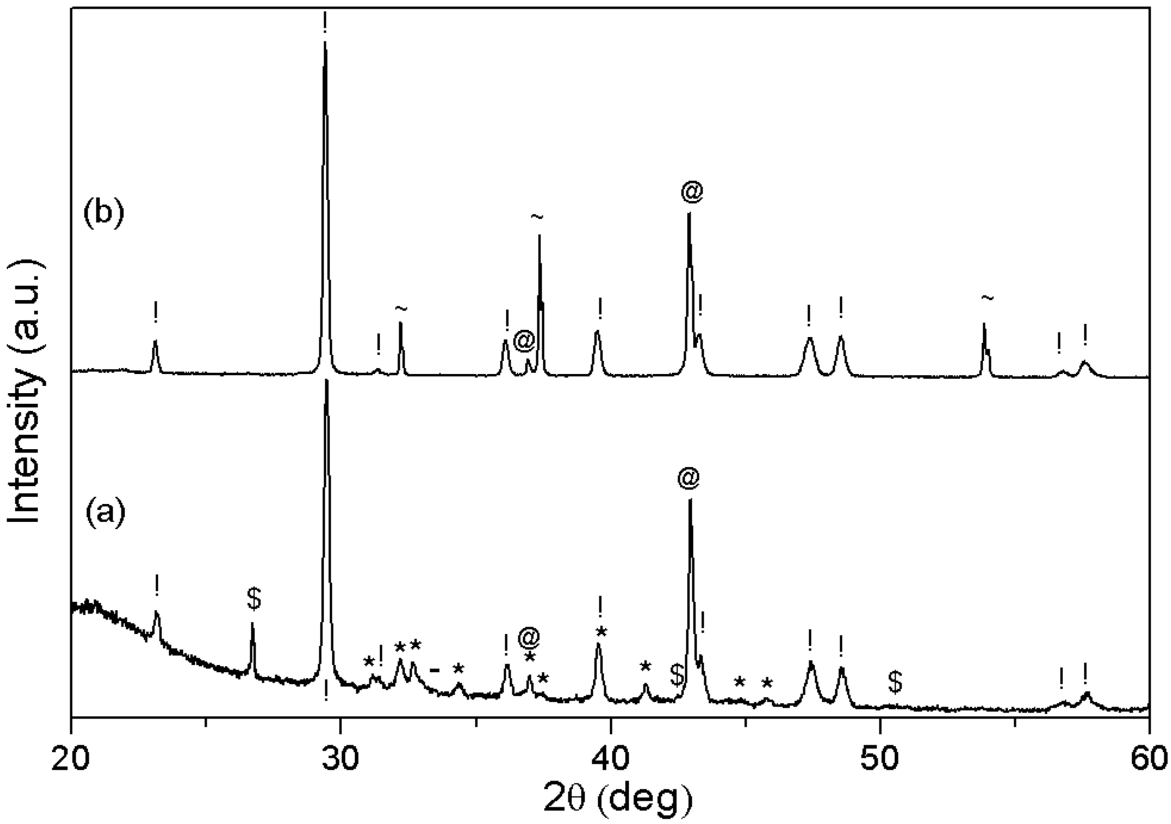

Figure S3. XRD analysis of carbonated (a) Watheroo dolomite (Wath-C) and (b) synthetic dolomite (Synth-C) reacted at 500 °C and 50 bar CO_2. ! = calcite, $ = quartz, * = larnite, @ = MgO, - = $Ca_9(Al_2O_6)_3$. λ = $CuK\alpha_{1,2}$.

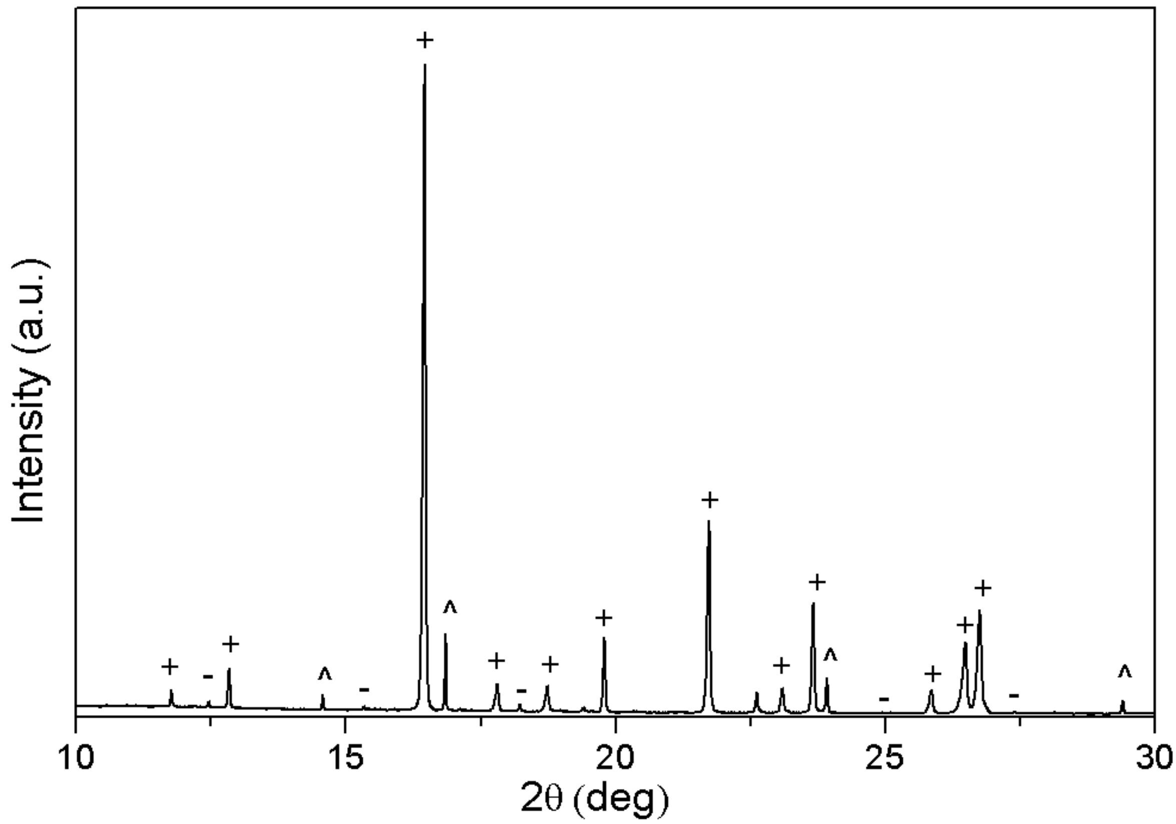

Figure S4. XRD analysis of carbonated synthetic dolomite and catalyst (Synth-C-cat) reacted at 500 °C and 50 bar CO_2. + = Dolomite, ^ = NaCl, - = $CaMg_2Cl_6(H_2O)_{12}$. λ = 0.8263076 Å.

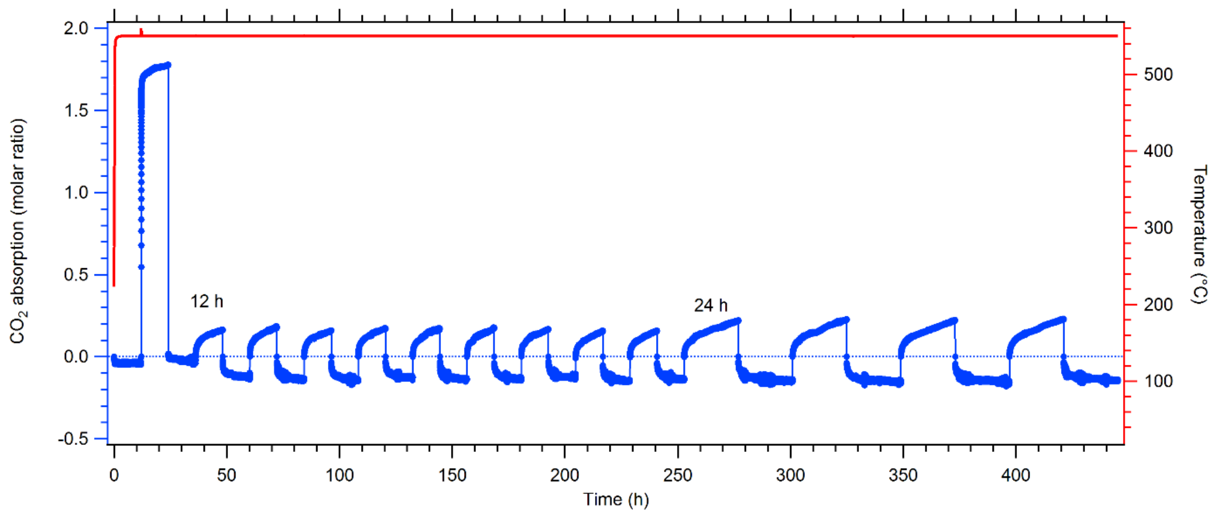

Figure S*5*. Carbon dioxide pressure cycling results for catalysed (NaCl:$MgCl_2$) synthetic dolomite at 525 °C (Synth-D-cat, CO_2 absorption pressure 35 bar, desorption pressure 2 bar).

Table S1. Molar quantity of CO_2 absorbed and desorbed during Carbon dioxide pressure cycling for catalysed ($NaCl:MgCl_2$) Watheroo dolomite (Wath-B-cat) and catalysed ($NaCl:MgCl_2$) synthetic dolomite (Synth-D-cat). Uncertainties vary between absorption (± 0.01 mol) and desorption (± 0.1 mol) for the Wath-B-cat sample due to a larger reservoir volume being employed during the desorption measurement. Uncertainties for Synth-D-cat are ± 0.01 mol.

	Molar quantity of CO_2	
Cycle	Wath-B-cat	Synth-D-cat
1 - Absorption	1.09	1.77
- Desorption	−0.3	−0.02
2 - Absorption	0.46	0.16
- Desorption	−0.4	−0.12
3 - Absorption	0.47	0.18
- Desorption	−0.5	−0.14
4 - Absorption	0.45	0.16
- Desorption	−0.5	−0.14
5 - Absorption	0.43	0.17
- Desorption	−0.5	−0.13
6 - Absorption	0.47	0.17
- Desorption	−0.5	−0.14
7 - Absorption	0.45	0.17
- Desorption	−0.5	−0.14
8 - Absorption	0.57	0.16
- Desorption	−0.5	−0.13
9 - Absorption	0.54	0.16
- Desorption	−0.5	−0.14
10 - Absorption	0.60	0.16
- Desorption	−0.5	−0.13
11 - Absorption	0.55	0.22
- Desorption	---	−0.15
12 - Absorption	---	0.22
- Desorption	---	−0.16
13 - Absorption	---	0.22
- Desorption	---	−0.15
14 - Absorption	---	0.23
- Desorption	---	−0.14

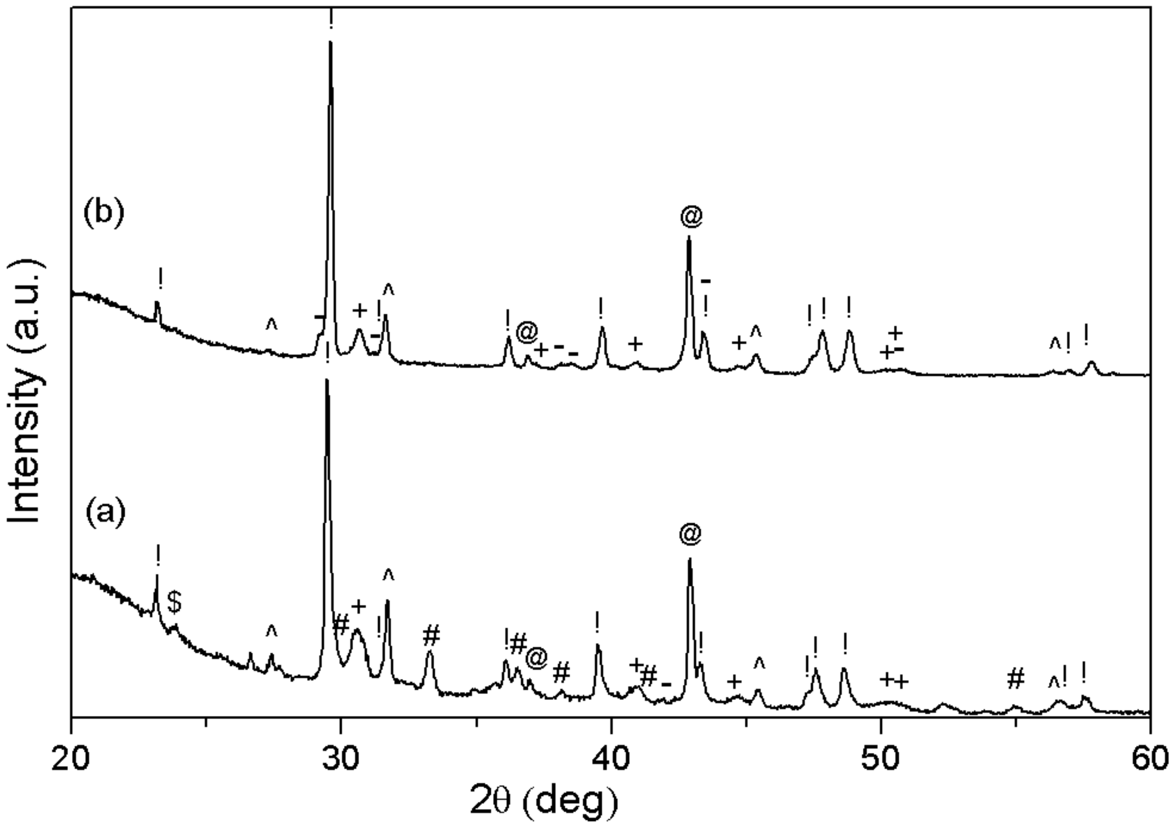

Figure S6. XRD analysis of cycled (a) Watheroo dolomite (Wath-D-cat) and (b) synthetic dolomite (Synth-D-cat) measured after absorption of CO_2. + = Dolomite, ! = calcite, @ = MgO, ^ = NaCl, $ = quartz, # = andradite, - = $CaCl_2$. λ = $CuK\alpha_{1,2}$. CO_2 absorption pressure 35 bar, desorption pressure 2 bar.

Table S2. Brunauer–Emmett–Teller (BET) surface area, cumulative pore volume and average pore size of the synthetic and mined dolomite samples from the Barrett–Joyner–Halenda (BJH) method.

Sample name	BET surface area (m^2/g)	BJH adsorption cumulative volume of pores (cm^3/g)	BJH adsorption average pore width (nm)
Rich-A Richgro dolomite	16.90 ± 0.16	0.0155	4.5
Wath-A Watheroo dolomite	16.78 ± 0.16	0.0146	4.6
Synth-B Synthetic CaO/MgO	0.98 ± 0.01	0.0014	7.5
Rich-B Calcined Richgro (from Rich-A)	4.95 ± 0.03	0.0047	4.7
Wath-B Calcined Watheroo (from Wath-A)	6.19 ± 0.02	0.0061	4.7