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Energy Storage Rocks: Metal Carbonates as Thermochemical Energy Storage Materials

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The intermittent nature of renewable energy is a major challenge that can be overcome via cheap and effective energy storage [1]. Thermochemical energy storage is an upcoming technology that can improve efficiency in applications such as concentrated solar power[2]. Metal carbonates have great potential as thermochemical energy storage materials, through the reversible endo/exothermic desorption/absorption of carbon dioxide (CO₂)[3]. However, major challenges include the loss of cyclic capacity and slow reaction kinetics[3].
Recently, it has been established that raw unrefined dolomite, CaMg(CO₃)₂, performed significantly better than laboratory synthesized dolomite due to the positive effect of chemically inert impurities present in the sample[4] However, increasing its relatively low operational temperature (550 °C) will improve efficiency[4]. The present research explores reactive metal carbonate composites, which consist of barium carbonate destabilised using titanium (IV) oxide (TiO₂) or barium silicate (BaSiO₃)[5]. This reduces the operating temperature from 1400 °C to, more suitable temperatures of 1100 °C and 850 °C, respectively, and improves kinetics of CO₂ release and uptake. The reactions are explored using in situ synchrotron XRD combined with a variety of other characterisation techniques.
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[2] C. Prieto, P. Cooper, A.I. Fernández, and L.F. Cabeza, Renew. Sustain. Energy Rev. 60, 909 (2016).
[3] L. André, S. Abanades, and G. Flamant, Renew. Sustain. Energy Rev. 64, 703 (2016).
[4] T.D. Humphries, K.T. Møller, W.D.A. Rickard, M.V. Sofianos, S. Liu, C.E. Buckley, and M. Paskevicius, J. Mater. Chem. A 7, 1206 (2019).
[5] K.T. Møller, K. Williamson, C.E. Buckley, and M. Paskevicius, J. Mater. Chem. A 8, 10935 (2020).

Presenter Gender

Man

Do you wish to take part in the Student Poster Slam

Yes

Condition of submission

Yes

Students Only - Are you interested in AINSE student funding

Yes

Level of Expertise

Student

Pronouns

He/Him

Which facility did you use for your research

Australian Synchrotron

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