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Short communication

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A critical assessment of the testing conditions of CaO-based CO₂ sorbents**Felix Donat^{*}, Christoph R. Müller**

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Abstract

Calcium (or carbonate) looping (CaL) is a high-temperature process to capture CO₂ from industrial installation using CaO-based materials as the sorbent. A large number of natural and synthetic CaO-based sorbents for CO₂ capture have been developed and investigated in the laboratory by cycling the material between a low-temperature carbonation stage and a high-temperature calcination stage. We demonstrate the importance of the exact experimental protocol chosen to transition from the carbonation to the calcination step by varying the CO₂ concentration and the heating rate while keeping the conditions during the actual carbonation (650°C, 15 vol.% CO₂) and calcination (950°C, 80 vol.% CO₂) stages constant. The experiments were performed in a thermogravimetric analyser, the equipment most frequently used in investigations of the cyclic CO₂ uptake, using a natural limestone as the sorbent. Our results show that the reaction conditions under which the CaCO₃ is decomposed to CaO determines the cyclic performance of the sorbent, whereas the effect of the CO₂ concentration during the set calcination stage (which usually begins after most of the CaCO₃ has been converted to CaO) appears to be insignificant. Higher heating rates facilitate a higher cyclic CO₂ uptake because the carbonate phase, known to be prone to sintering, is exposed to higher temperatures for a shorter time. The reaction conditions during the transition period crucially affect the CO₂ uptake determined in laboratory tests and hence need to be reported in full detail, yet this is currently hardly the case. Otherwise it is unclear whether differences in the CO₂ uptake of different CO₂ sorbents are due to modifications of the material or variations in the testing protocol.

Keywords: Calcium looping, CO₂ capture, CaO-based sorbent, Calcination, Carbonation

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