[MS28-P07] Reversible CO2 absorption by the 6H perovskite Ba4Sb2O9

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In order to combat the climate change owing to the ever-increasing concentration of CO_2 in the atmosphere due to anthropogenic emissions, we must change the way by which energy is primarily generated, that is by combustion of fossil fuels. The carbon capture and storage (CCS) scheme offers a plausible solution to the urgent need for a carbon neutral energy source from stationary sources, including power plants and industrial processes, since energy generated from renewable sources such as wind, solar and biomass are unlikely to meet the demand over the next two decades. The most mature technology for post-combustion capture uses a liquid sorbent, amine scrubbing. However, with the existing technology, a large amount of heat is required for the regeneration of the liquid sorbent, which introduces a substantial energy penalty [1].The use of alternative sorbents for CO_2 capture, such as CaO, has been investigated extensively in recent years [2]. However there are significant problems associated with the use of CaO based sorbents, the most challenging one being the deactivation of the sorbent material. When almost pure CaO sorbents such as limestone are used, the capture capacity of the solid sorbent could fall by as much as 90 mol % after the first few carbonation-regeneration cycles. In this study of a novel compound for CCS applications, the 6H perovskite $Ba_4Sb_2O_9$ is found to be able to absorb CO_2 through a chemical reaction at 873 K to form $BaCO_3$ and $BaSb_2O_6$. This absorption is shown to be reversible through the regeneration of the original $Ba_4Sb_2O_9$ material upon heating above 1273 K accompanied by the release of CO_2 gas. A combined synchrotron X-ray diffraction and thermogravimetric study was carried out to characterise the physical absorption properties and to analyse the structural evolution and formation of phases in situ. Importantly, through cycling the material over 100 cycles (Figure 1), it is shown that the combined absorption and desorption reactions can proceed without a loss in CO_2 absorption capacity of the material, representing the first perovskite material to be experimentally reported to show such properties.

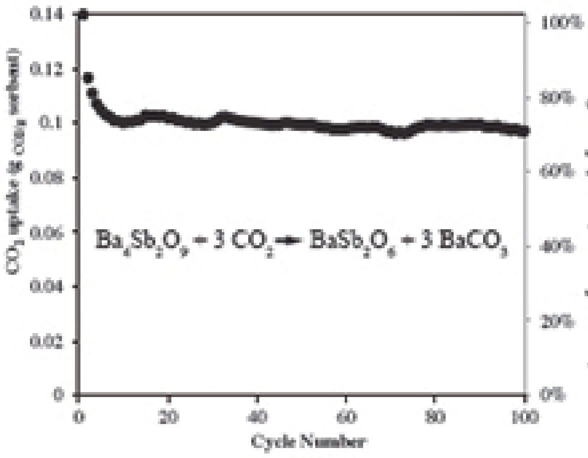

Figure 1. CO_2 uptake of $Ba_4Sb_2O_9$ as a function of cycle number.

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