

## Thermochemical Study of $\text{Ca}(\text{OH})_2$ - $\text{CaCO}_3$ Cycle for $\text{CO}_2$ Capture from Air and Co-Produce $\text{H}_2$

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### ABSTRACT

The combination of the release of  $\text{CO}_2$  from the decomposition of  $\text{CaCO}_3$ , with the  $\text{CO}_2$ -consuming dry reforming of  $\text{CH}_4$ , it is possible to simultaneously co-produce  $\text{CaO}$  and syngas in a single reaction. The benefit of such a combination is the considerable decrease of  $\text{CO}_2$  emissions vis-à-vis the separate production of these two valuable commodities. Catalytic effects of decomposition/reforming of hydrocarbons using Ca-components have been studied with regard to coal gasification processes. Both  $\text{CaO}$ -producing reactions, reverse reaction, are highly endothermic and proceed at temperatures above 1300K. So that, they are attractive candidates for the use of concentrated solar energy as the source of high-temperature process heat, avoiding emissions such as  $\text{CO}_x$ ,  $\text{NO}_x$ ,  $\text{SO}_x$  and other pollutants derived from the combustion of fossil fuels.

This paper examines thermochemically a  $\text{Ca}(\text{OH})_2$ - $\text{CaCO}_3$  cycle led to the capture of  $\text{CO}_2$  from the air using concentrated solar energy. Open cycle material that co-produces hydrogen is analyzed. The equilibrium composition of the relevant reactions, temperature requirements and energy balances are calculated based on operating conditions, and the main sources of irreversibility are identified.

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**Keywords:**  $\text{CO}_2$  capture; Hydrogen; Methane reforming

