# Carbonate Looping for De-Carbonization of Cement Plants

**Pathi, Sharat Kumar; Andersen, Maria Friberg; Lin, Weigang; Illerup, Jytte Boll; Dam-Johansen, Kim; Hjuler, Klaus**

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# Carbonate looping for de-carbonization of cement plant

[1]Sharat Kumar Pathi[1]*, [1]Maria Friberg Andersen, [1]Weigang Lin, [1]Jytte Boll Illerup, [1]Kim Dam-Johansen
[1] *CHEC Research Centre, Department of Chemical and Bio-Chemical Engineering, DTU, Lyngby, Denmark*
[2]Klaus Hjuler
[2]*FLSmidth A/S, Research and Development, Valby, Denmark*

***Abstract***

*Cement industry is one of the largest emitter of $CO_2$ other than power generation plants, which includes the emissions from combustion of fuel and also from calcination of limestone for clinker production. In order to reduce $CO_2$ emissions from the cement industry an effective an economically feasible technology is to be developed. The carbonate looping process is a promising technology, which is particularly suitable for the cement industry as limestone could be used for capture and release of $CO_2$. Integration of carbonate looping process into cement pyro-process has two advantages: 1) to capture emitted $CO_2$ and 2) to generate power for internal use, because high quality energy can be recovered from carbonate looping which is operated at high temperature unlike amine process. A simple carbonate looping process model was developed based on average conversion of calcined limestone defined by Abanades et al. The model is used to investigate the influence of average conversion of limestone in the carbonator on the flow rates of different streams in the looping process and energy required in the calciner for re-activation. The model developed is used for studying the carbonate looping process integrated into cement pyro-process. The energy required for regeneration in the calciner increases with increase in average conversion of calcined limestone and energy that can be extracted from carbonator decreases with increasing average conversion. Further the influence of type of limestone on the calciner capacity is also investigated. The results from this simple model show the importance of cement industry to the carbon capture technology for its application to power plants.*

***Originality***

*A major step towards sustainable production of cement is to capture carbon emitted from the process. Presently there is no technology applied on large scale for carbon capture. The carbonate looping process has the potential to be applied at industrial scale and it is especially suitable for the cement industry. So as a first step a simple model was developed to investigate the influence of the average conversion of calcined limestone in the carbonator on all flow streams in the looping process integrated to a cement plant.*

***Chief contributions***

*The model estimates the energy to be extracted from the carbonator for e.g. electricity generation by carbonate looping integrated with the cement process. The carbonation energy increases with decreasing average conversion of the calcined limestone, whereas the energy required for calcination (regeneration) decreases with decreasing average conversion. The model provides an useful tool for optimization of the carbonate looping process applied to cement industry.*

***Keywords:*** *$CO_2$ capture, carbonate looping, type of limestone, cement plant*

*** Corresponding author: Email skp@kt.dtu.dk Tel +45252839, Fax +4545882258**