

A Study on the Fixed amount of CO₂ and the estimation of production of CaCO₃ on Waste Concrete Powder by Wet Carbonation

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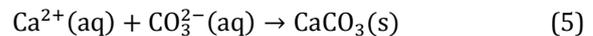
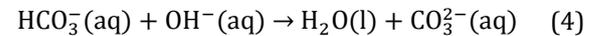
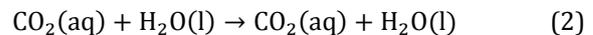
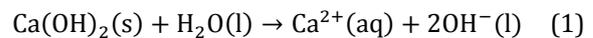
Introduction

According to the 2007 nation's standards on CO₂ emissions, Carbon dioxide emissions of the South Korea was surveyed 480million ton. This rate ranks as the ninth highest of the companies surveyed and this figure is good indicator of the CO₂ emissions seriousness. Waste concrete generated by construction industries is 45billion in the country every year. The above subjects are becoming the main issue of society. Therefore, to study the method of recycling mortar slag of waste concrete based on chemical experiment which react to carbon dioxide using Ca(OH)₂. And there is the purpose that suggest fundamental resource for CO₂ reduction. In this study, we analyze the absorption mechanism using Ca(OH)₂ component of waste concrete powder which can be solidify carbon dioxide.

In addition, we checked the component of CaCO₃ which created by reaction between the waste concrete powder and carbon dioxide. And we were reviewed that this study can create high value-added industry.

Experimental

Wet carbonation which inject the carbon dioxide gas at saturated solution of Ca(OH)₂ make the calcium carbonate. This chemical reaction is the non-uniform reaction including solids, liquids, and gases. Also this reaction proceed through the dissociative reaction of Ca(OH)₂, the hydration reaction of carbon dioxide and the formation reaction of CaCO₃. Ca(OH)₂ keeps liquefied because it has limited solubility in water and depending on the temperature it's pH indicates 12~13. If the carbon dioxide was injected into aqueous solution, calcium carbonate is formed from the neutralization reaction. Mechanism of reaction phase which formed CaCO₃ by injecting Ca(OH)₂ in an aqueous solution is as in the following.



In this experiment, we fabricated the cement paste in order to estimate absorbed amount of carbon dioxide of waste concrete powder (mainly hydrates of cement) and measured the weight of Ca(OH)₂ in the cement paste. Also we calculated quantitatively amount of water which can be saturated the included Ca(OH)₂ in waste concrete of 1m³ (cubic metre) and can absorb amount of carbon dioxide through injecting the CO₂ gas in saturated solution.

In addition we analyze the particle size and component of CaCO₃ with FE-SEM picture after reaction between carbon dioxide and saturated solution of Ca(OH)₂.

Results and Discussion

The pH of the reaction between carbon dioxide and saturated solution of Ca(OH)₂ decreased gradually during first 4 minutes but sharply dropped during next 2 minutes. And it shows neuter characteristic after end of reaction.

Initial pH value of solution of Ca(OH)₂ indicate a strong alkali which pH value is 12~13 due to the

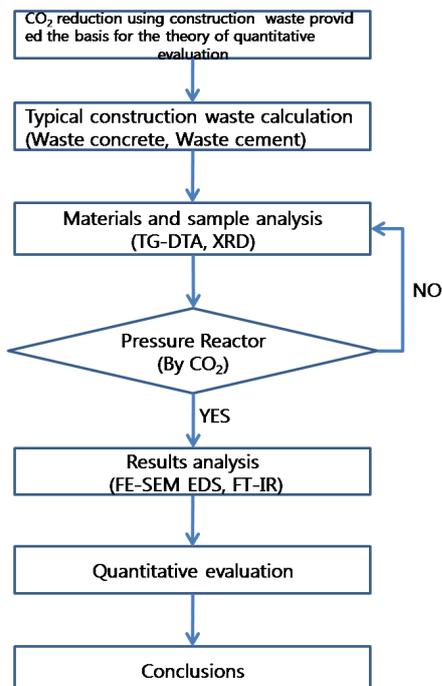


Fig 1. Using wet carbonation CaCO₃ generation 1m³ measurement of the CO₂ fixed and Process

dissociation of $\text{Ca}(\text{OH})_2$ and increasing the OH^- ions. But, OH^- ions were consumed by reaction of carbon dioxide like formular (3) during reaction. Therefore, it concluded that pH value decline slowly.

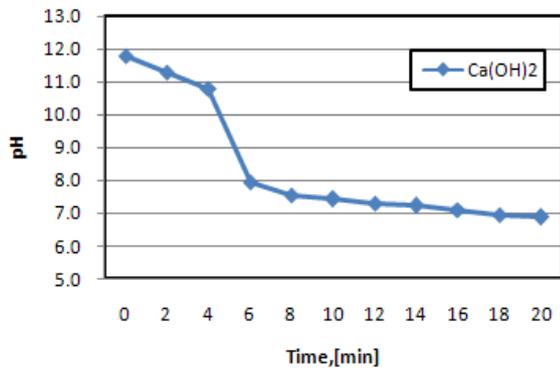


Fig 2. $\text{Ca}(\text{OH})_2$ - CO_2 during the reaction pH change

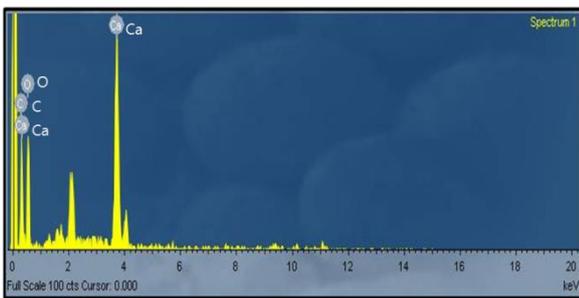


Fig 3. $\text{Ca}(\text{OH})_2$ - CO_2 reactor sludge EDS peak

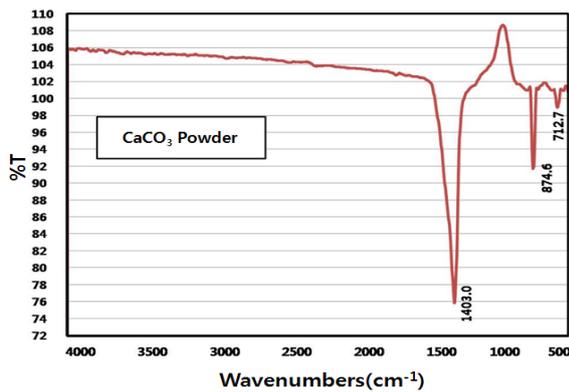
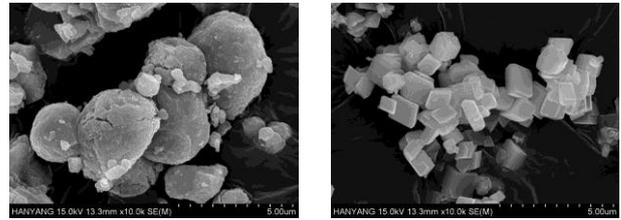


Fig 4. $\text{Ca}(\text{OH})_2$ - CO_2 reactor sludge FT-IR peak

Precipitate can be shown that it consist of pure CaCO_3 as shown in the EDS peak. Formed precipitate by the reaction of $\text{Ca}(\text{OH})_2$ -carbon dioxide is considered of pure calcium carbonate of sedimental type free of impurities.

In Figure 4, it is showing the FT-IR peak of the reaction precipitate. It is a typical peak of CaCO_3 and the strongest peak can be shown around 1400. And the peak from 4000 to 2000 form a rectilinear figure. So, this considered of pure CaCO_3 free of impurities.



a) $\text{Ca}(\text{OH})_2$

b) CaCO_3

Fig 5. Before and after FE-SEM picture

The FE-SEM result of precipitate crystal before and after the reaction of $\text{Ca}(\text{OH})_2$ -carbon dioxide is as figure 5.

In figure 5, Shape of crystal has a hexahedral structure and condensed with layers also it has characteristic of equable particle size.

Conclusion

The reaction of $\text{Ca}(\text{OH})_2$ -carbon dioxide create pure calcium carbonate and absorbed carbon dioxide using $\text{Ca}(\text{OH})_2$ component of waste cement.

This can recycle the construction waste and reduce the carbon dioxide. In addition, when create the high value-added industries which generate high-purity of CaCO_3 , this can be used as fundamental data.

Acknowledgements

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