Enhanced CO2 Capture via Carbon Mineralization

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There have been increasing concerns about global warming caused by greenhouse gases, particularly CO2 emissions from industry. The manufacturing of cement products accounts for approximately 7-8% global CO2 emissions. During cement utilization, however, concrete carbonization (i.e. carbon mineralization, the conversion of CO2 into minerals) can offset less than half of the CO2 emissions associated with cement production. The Global Cement and Concrete Association has an ambitious commitment to carbon neutrality by 2050, and thus new technologies have to be put in place to achieve the goal. In this study, reaction conditions were optimized to effectively improve concrete carbonization efficiency. Regular cement materials were also successfully modified with specialty additives, including calcium hydroxide and MEA (monoethanolamine). Calcium hydroxide was able to enhance cement carbon capture by over 20%, and MEA was able to enhance cement carbon capture by over 100%. Based on the results, specific carbonation mechanisms were utilized to successfully explain the enhancement of CO2 capture of the modified cement materials. In addition, the MEA-modified cement materials also demonstrated potential for concrete recycling and circular utilization.