Name(s)

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Project Number

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Project Title

Producing a Corrosion Resistant and Environmentally Friendly Concrete by Using the Salt Water Carbonate Buffer System

Abstract

Objectives

In order to minimize the Carbon dioxide emission from concrete production, our project sought to find an environmentally sustainable method that would allow for the formation of a Calcium Carbonate based concrete, instead of the carbon dioxide producing silica-based concrete in the status quo. The first target was to achieve a form of Calcium carbonate crystallization around a series of aggregates. The second goal was to improve the corrosion resistance of concrete, to protect against acid rain.

Methods

To create the concrete, different combinations of CaCl2, Mg (OH)2, H2O, and aggregate were placed in a vacuum chamber saturated with various torr of CO2 over the course of 50 trials. The series of chemicals used, helped imitate the saltwater-carbonate buffer system which produced carbonate ion that promptly reacted with the calcium cations in the solution. The end product was a calcium carbonate lattice that binds together aggregate.

In order to protect the calcium carbonate in our concrete from corrosive elements, a super hydrophobic coating, made from stearin, microcrystalline, carnauba, and micro beads was created. The stearin emulsified the non-polar materials, whereas the microbeads and a mesh procedure increased hydrophobicity and resistance to corrosive materials by promoting capillary action and collection of air molecules within the crevasses.

Results

Our results suggested that a 6.25/.6/2.5/192.5/1 mole ratio for CaCl2, Mg(OH)2, Ca(OH)2,CO2 and water, allowed for the production of CaCO3 based concrete, that sequestered carbon dioxide. Next, the super hydrophobic layer created consistent 150-degree angles between water droplets and the surface and repelled a diluted 4 pH solution of sulfuric acid, meant to replicate acid rain, repeatedly over the course of 50 trials.

Conclusions

By the end of the experiment a novel procedure to creating environmentally friendly concrete was created, as well as a non-toxic corrosion resistant spray that can be applied on any concrete or material.

Summary Statement

W produced a corrosion resistant and environmentally favorable concrete, using various ingredients and sequestered carbon dioxide.

Help Received

We conducted our experimentation in Julia Patton's Lab at Crescenta Valley High School, and received feedback from Orenda Tuason.