Solidia Cement®, a new low carbon binder

Solidia Technologies™: Start-up company in US, founded in 2008
Raised a total of 80 M$ from investors (Kleiner Perkins Caufield & Byers, Bright Capital, BASF Venture Capital, BP Ventures, LafargeHolcim, Total, Air liquide)

A new binder dedicated to precast industry

A calcium-silicate cement based on mineral carbonation and offering 50 – 70% CO₂ savings compared to OPC

Partnership LafargeHolcim / Solidia

Technical solution: cement & concrete

Solidia clinker mineralogy & thermodynamic simulations

- No Hydration ➔ Carbonation ➔ Carbonatable phases targeted
- XRD Rietveld phases quantification

Wollastonite, CaSiO₃, Reactive phases 40 to 60%
Rankinite, Ca₃SiO₅, Semi reactive phases
Belite, Ca₃S, Amorphous
Mellite (Ca₂Al₂Mg₂Si₆O₁₈), Akermanite (CaMg₂Si₂O₇), Gehlenite (Ca₂Al₂O₇Si₂O₁₂)

- Thermodynamic simulations: a good quality indicator
- HT DSC, a good lab indicator for industrial productibility

Mineral carbonation

- Carbonation reaction with clinker reactive phases

CO₂ + Ca₂SiO₄ → CaCO₃ + SiO₂
CO₂ + Ca₃SiO₅ → CaCO₃ + 2SiO₂
CO₂ + Ca₃S → CaCO₃ + 3S
CO₂ + Ca₂Al₂Mg₂Si₆O₁₈ → CaCO₃ + 2SiO₂ + 2Al₂O₃ + MgO

From clinker phases... to ... carbonated cement

<table>
<thead>
<tr>
<th>Concrete Product</th>
<th>Mass Gain (CO₂ uptake), %</th>
<th>CO₂ Sequestered/t of Cement</th>
<th>CO₂ Savings/t of Cement</th>
<th>Total CO₂ Savings/t of Cement</th>
<th>Total CO₂ Savings, % (vs. 810kg for OPC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solidia Paver</td>
<td>3.4</td>
<td>236 kg</td>
<td>245 kg</td>
<td>481 kg</td>
<td>59.4</td>
</tr>
<tr>
<td>Solidia Hollow Core</td>
<td>3.3</td>
<td>220 kg</td>
<td>245 kg</td>
<td>465 kg</td>
<td>57.4</td>
</tr>
</tbody>
</table>

Two applications examples

- Pavers
- Hollow cores

CO₂ captured in the concrete | CO₂ saved during clinker production

www.solidlife.eu

The Future of Cement, 200 years after Louis Vicat », 6-8 June 2017, UNESCO, Paris