

CarbonCure Durability Assessment Report

TECHNICAL NOTE

Sean Monkman, PhD PEng, SVP Technology Development, CarbonCure Technologies
Michael Thomas, PhD PEng, Professor, Department of Civil Engineering, University of New Brunswick

EXECUTIVE SUMMARY

Concrete was produced using the CarbonCure Ready Mix Concrete Technology whereby carbon dioxide was injected into the concrete during its mixing. The concrete was assessed in the fresh and hardened states and compared to a reference control batch. An extensive durability assessment determined the overall suitability of a class C1 mix produced using the CarbonCure Technology.

The fresh properties of the concrete were unaffected by the carbon dioxide. The compressive strengths were increase 1 to 9% in test ages up to 91 days. The conclusions regarding absorption, drying shrinkage, surface resistivity, bulk resistivity, RCPT, corrosion measurements and pore solution pH were unaltered by the carbon dioxide treatment. Flexural strength increased 6%. Abrasion mass loss improved 7%. The depths of carbonation after accelerated service carbonation were decreased 25 to 54%. Bulk chloride diffusion was unaffected at 180 days of ponding.

Table 5: Resistivity and RCPT data for control and carbon dioxide-treated concrete

| Batch | Proceq (kΩ.cm) | RCON (kΩ.cm) | RCPT @ 56d, coulombs | RCPT rating |
|--------------|-----------------------|---------------------|-----------------------------|--------------------|
| Control | 11.43 | 6.48 | 2403 | Moderate |
| CO2 | 11.00 | 6.28 | 2785 | Moderate |

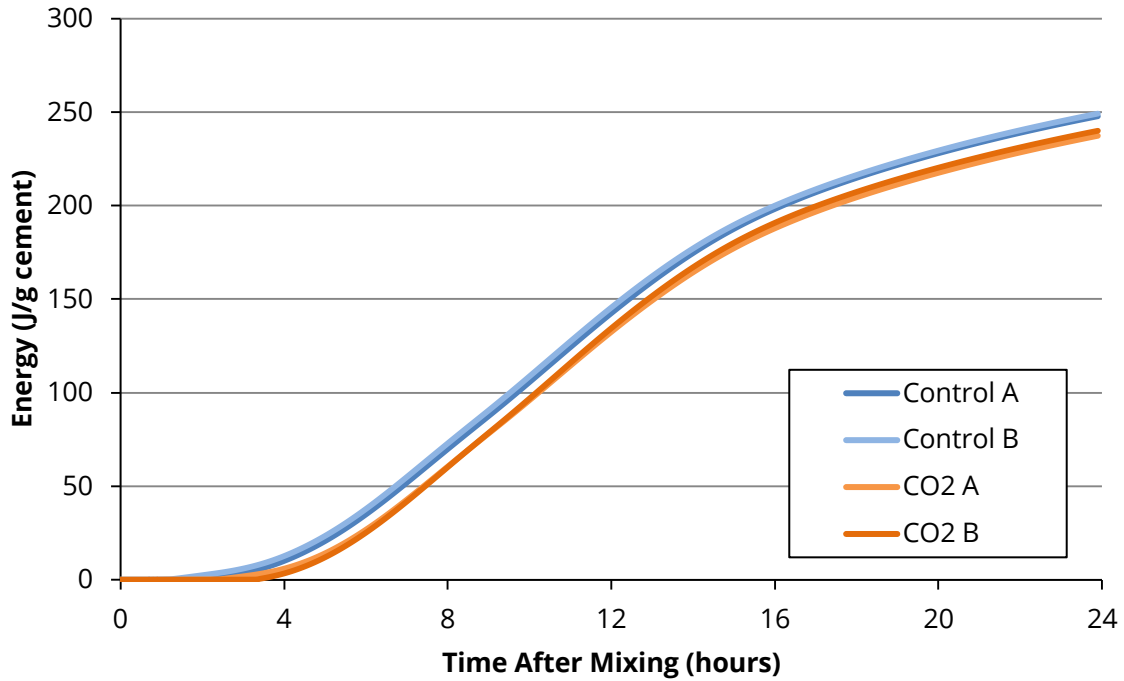
FIGURES


Figure 1: Isothermal calorimetry for control and carbon dioxide-treated batch through 24 hours

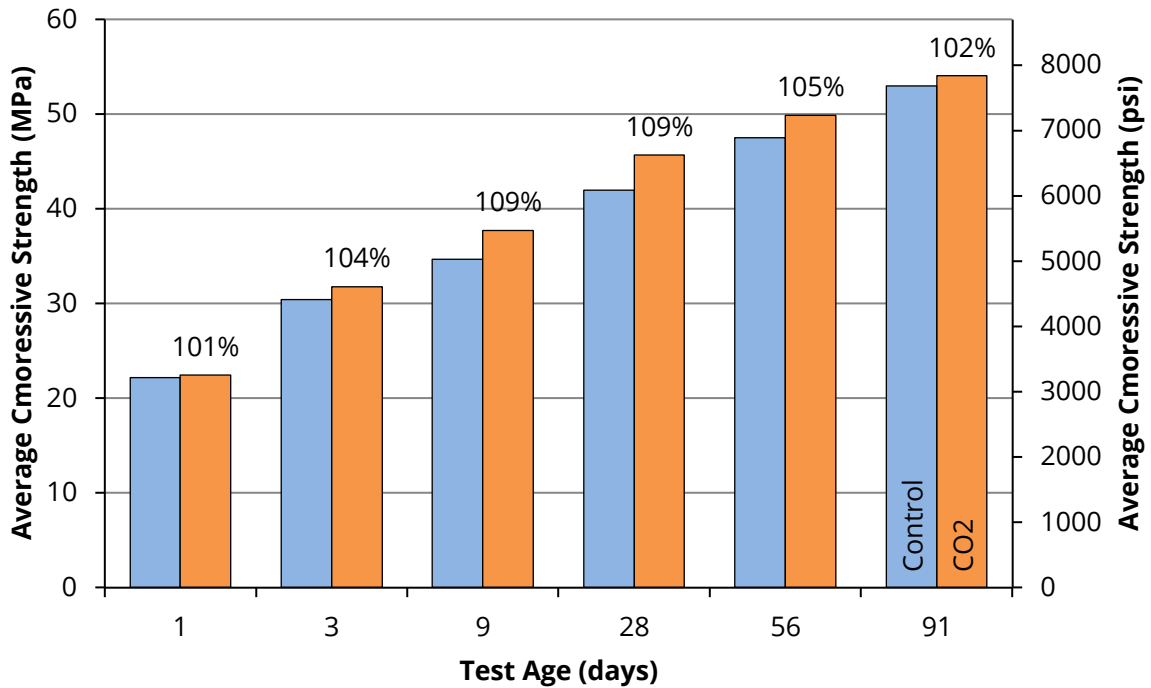


Figure 2: Compressive strength for control and carbon dioxide-treated batch through 91 days

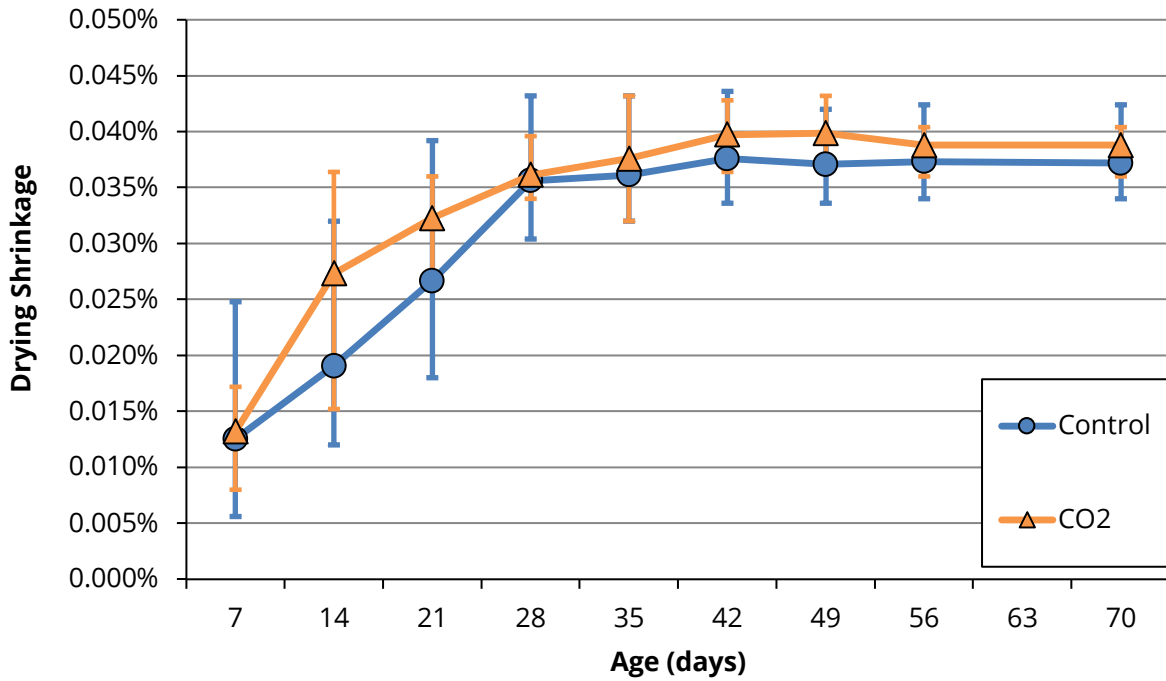


Figure 3: Drying shrinkage for control (high-low-average) and carbon dioxide-treated batches

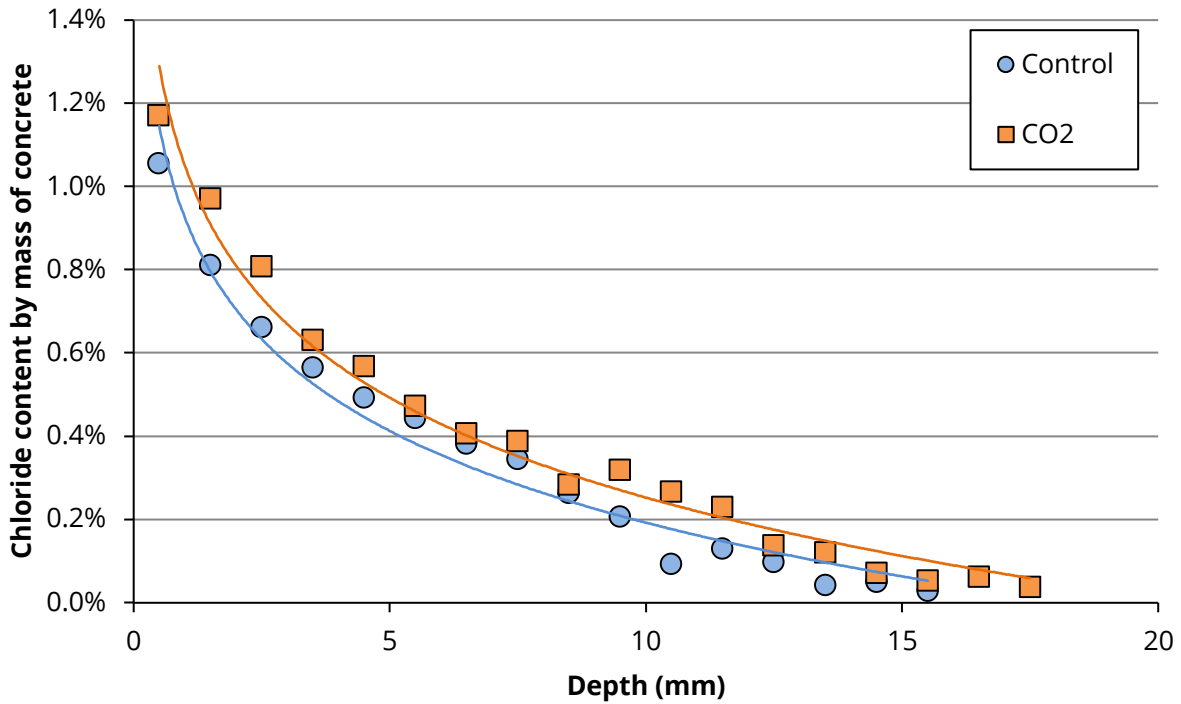


Figure 4: Bulk diffusion analysis of control and carbon dioxide-treated concrete after 35 days of chloride ponding

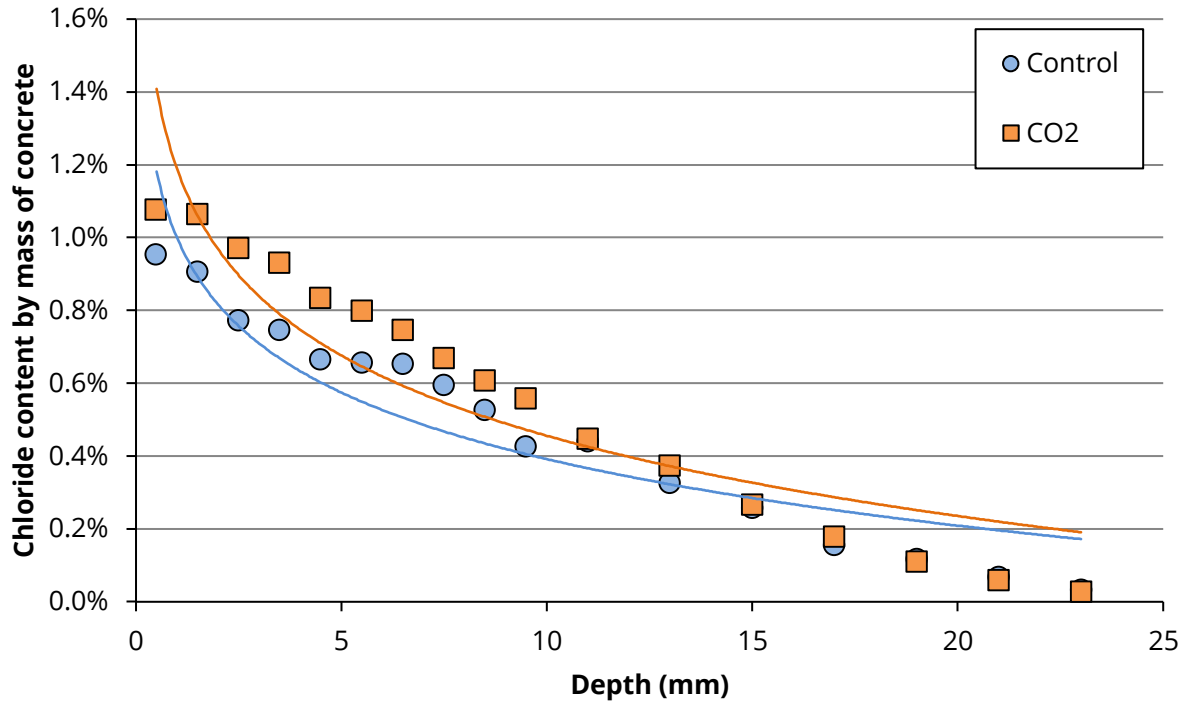


Figure 5: Bulk diffusion analysis of control and carbon dioxide-treated concrete after 180 days of chloride ponding

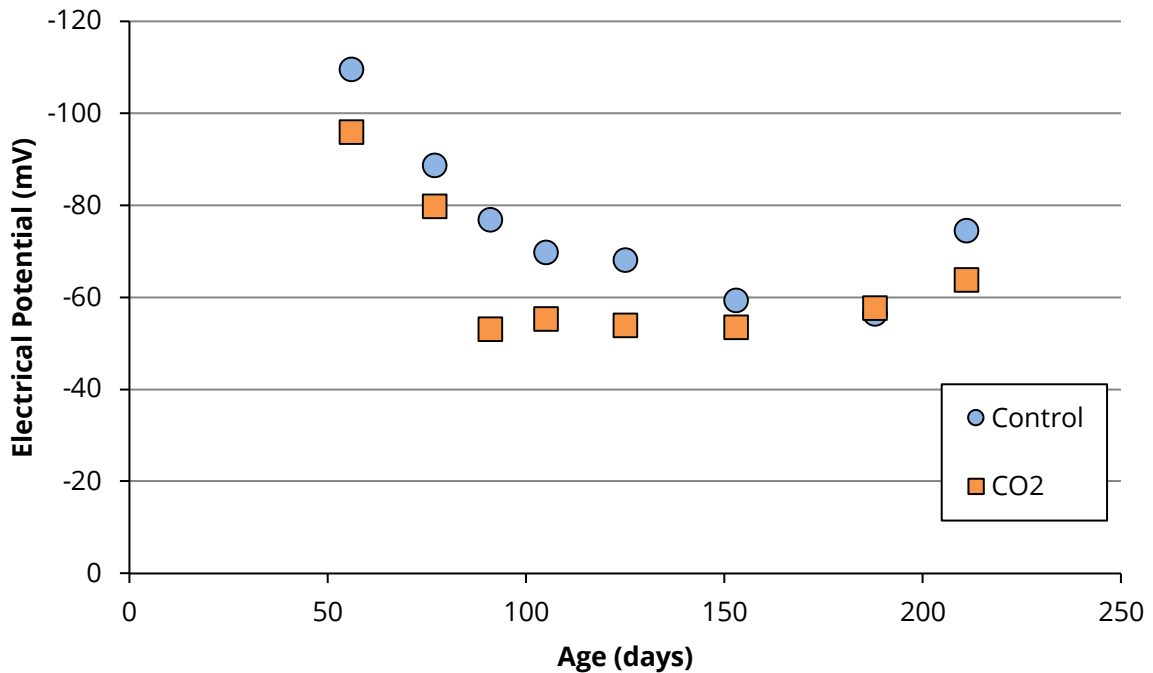


Figure 6: Electrical potential measurements of control and carbon dioxide-treated concrete through 211 days of corrosion monitoring

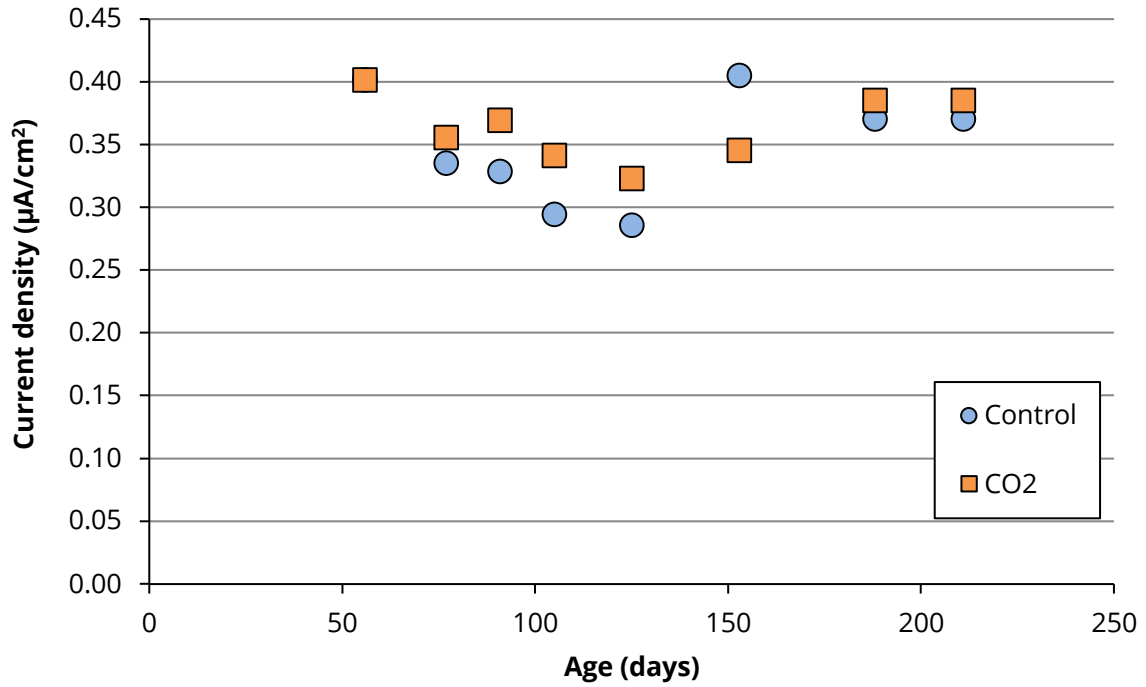


Figure 7: Current density measurements of control and carbon dioxide-treated concrete through 211 days of corrosion monitoring

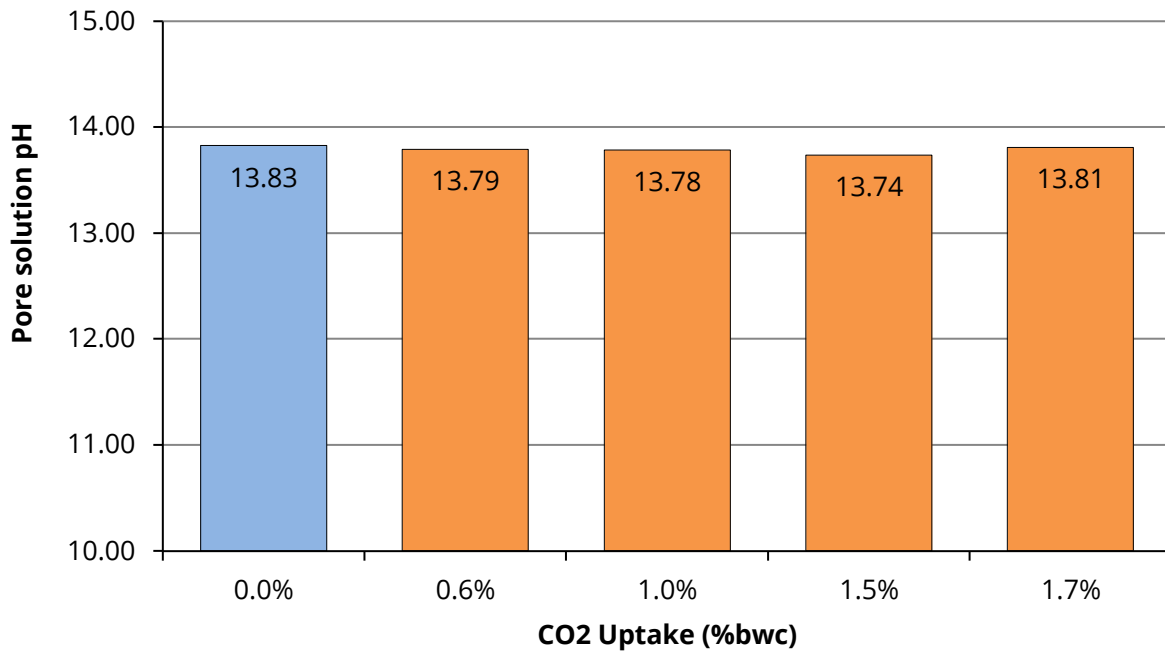


Figure 8: Pore solution pH for control and carbon dioxide-treated pastes