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CarbonCure Technologies, which injects and mineralizes CO2 into concrete during mixing vs a credentialed carbon-sequestration attestation architecture

CarbonCure Technologies injects and mineralizes captured CO2 into concrete during mixing, permanently locking a measured mass of carbon into the finished pour. The open problem it leaves untouched is not the chemistry but the credential: how a per-pour sequestration claim stays verifiable, transferable, and revocable as that concrete is incorporated into a structure, renovated, re-credentialed, and eventually decommissioned. This article addresses that axis using the home inventive step of Credentialed Surfaces, disclosed in U.S. Provisional Application No. 64/050,895, which frames carbon sequestration as a signed admissibility surface that migrates with the material across its whole lifecycle.

What CarbonCure Technologies, which injects and mineralizes CO2 into concrete during mixing Does

CarbonCure Technologies is a deployed, commercially shipping process technology in the concrete industry. Its core approach introduces captured carbon dioxide into fresh concrete during batching and mixing, where the CO2 reacts with calcium ions to form calcium carbonate that becomes chemically bound within the cured matrix. The mineralization is a genuine chemical reaction: the carbon is converted to a stable solid

phase rather than merely stored as gas, and the reaction can contribute to strength development, which in practice allows some formulations to reduce cement content while holding performance targets.

This is real, mass-produced technology installed at operating ready-mix and precast concrete plants across many markets. It integrates with existing batching equipment rather than requiring producers to rebuild their plants, and it comes paired with measurement and reporting workflows that quantify the CO2 utilized per cubic yard so that the associated reduction can be counted toward emissions accounting and carbon-market instruments. CarbonCure does the hard, credible work of turning a laboratory reaction into a plant-floor process at industrial volume, and of producing the utilization data that downstream carbon accounting depends on. Any fair comparison has to start by acknowledging that they ship a working, verified process today, and that the mineralization chemistry itself is well established prior art that predates and is independent of the disclosure discussed here.

The Architectural Axis

The axis this disclosure addresses sits alongside the chemistry, not against it. A mineralization process answers the question "how much carbon was bound into this batch, at this plant, on this day." What it does not, by itself, provide is a durable, machine-evaluable credential that binds that sequestration claim to a specific physical mass and then follows that mass through everything that happens to it afterward.

Concrete is not a static object. A pour is incorporated into a structural element, that element is inspected and rated by different authorities for different properties, the building is renovated and repaired over decades, surfaces are refreshed, and at end of life the material is crushed, recovered, or landfilled. Each of those transitions can affect whether an earlier carbon claim is still valid, who is entitled to assert it, and whether it has already been sold, retired, or double-counted. Today the sequestration claim is typically captured as a plant record and a report at the moment of production. The state

axis, whether the claim itself is a first-class object that survives incorporation, transfer, re-credentialing, and decommissioning, is a structural gap in how the claim is represented, not a defect in how the carbon was bound. It is precisely that representational axis the disclosure targets.

How the Disclosed Approach Differs

The disclosure treats carbon sequestration as a credentialed property surface of the building material rather than as a one-time production record. In the architecture, a credentialed structural element carries a composite admissibility profile made of independently signed surfaces, one of which is a carbon-sequestration admissibility surface. That surface is signed by an environmental-credit authority with declared scope and is bound to the element's identity through cryptographic signature, so a sequestration claim is not a loose document but an attestation attached to specific physical mass.

Two mechanisms in the specification do the work that a mixing-time process does not reach. First, the migrating carbon-attestation primitive: biogenic carbon-credit attestations bound to a credentialed substrate migrate with that substrate across material flows and across structural lifetimes, each migration being a credentialed transaction signed by an environmental-credit authority and recorded in a lineage chain. The specification describes this supporting continuous credentialed carbon-sequestration markets in which each cement pour, mortar repointing, surface-coating refresh, and re-credentialing event can issue, transfer, or extinguish carbon-credit attestations against specific structural mass. Second, the cradle-to-cradle lineage: the element's lifecycle is recorded as a directed graph of signed transitions, including pre-installation credentialing, in-service operation, end-of-structural-life decommissioning signed by a licensed deconstruction authority, and recycling-grade re-credentialing signed by a recycler authority. A carbon claim is therefore not only issued but can also be tracked, revalidated, or retired as the material moves, so that the credential's state stays coupled to the material's physical state.

The specification also describes a methane-avoidance attestation for its biomass-derived carbonaceous feedstock pathways, issued as a signed, independently queryable event recorded in the lineage chain and evaluable by carbon-market participants. The point for this comparison is architectural rather than chemical: the disclosure's contribution is that carbon-relevant claims of several kinds are represented as signed, composable, migrating attestations bound to material, not that any particular sequestration reaction is new. The reaction chemistry, biomass carbonization, and carbon accounting math it relies on are pre-existing science.

Where They Fit Together

These are complementary layers, and the honest framing is composition rather than competition. A mineralization process determines and measures how much carbon is durably bound into a given batch of concrete. The credentialing architecture determines how that measured fact is represented, signed, carried, and settled over the life of the material. A producer running CO2 mineralization is exactly the kind of manufacturer authority the architecture contemplates: the utilization measurement produced at the plant is precisely the input that would populate and sign a carbon-sequestration admissibility surface at the pre-installation credentialing stage.

In that arrangement, CarbonCure's process supplies the ground-truth carbon fact and the disclosed architecture supplies the credential that keeps that fact verifiable and transferable downstream. One is a way to put carbon into concrete; the other is a way to represent and govern the resulting claim as the concrete lives, is renovated, and is eventually recovered. Neither displaces the other, and the architecture is deliberately agnostic to which sequestration process produced the underlying carbon fact.

Boundary Conditions

The asymmetry here should be stated plainly. CarbonCure ships a validated, mass-produced process with real deployments and real measured results. The subject of this disclosure is a provisional patent application describing an architecture. It is not built, not benchmarked, and not independently validated, and this article asserts no energy-density, cost, throughput, or sequestration figures for the disclosed approach; the only quantitative statements above about CarbonCure describe the general nature of a mineralization process and should be verified against the company's own current published materials.

The underlying materials science the disclosure leans on, CO_2 mineralization, biomass carbonization, and carbon-market accounting, is pre-existing and independent of this filing. The novelty claimed is confined to the credentialing and attestation architecture: representing carbon sequestration as a signed admissibility surface, migrating carbon attestations bound to physical mass, and the cradle-to-cradle lineage of signed transitions. Whether such credentials would be recognized by any specific carbon registry, standard body, or building-code authority is an external adoption question this disclosure does not resolve, and real-world value would depend on those authorities choosing to sign and honor such surfaces. Nothing here should be read as asserting a deficiency in CarbonCure's product; the process addresses a chemistry problem the architecture does not attempt to solve.

Disclosure Scope

The architecture described here, credentialed carbon-sequestration surfaces, migrating carbon attestations, and cradle-to-cradle lineage recording, is disclosed in U.S. Provisional Application No. 64/050,895 and is the sole subject of this article's claims of novelty. All references to CarbonCure Technologies, to CO_2 mineralization in concrete, and to carbon-market accounting are provided as external context to locate the disclosure within a real and active field; they describe the surrounding market and

prior art and are not representations of the filing, and they are stated neutrally without asserting any defect, failure, or limitation on the part of CarbonCure or its products. The mineralization chemistry and carbon accounting referenced are pre-existing science that the disclosure does not claim to have invented. Any figures or characterizations attributed to CarbonCure should be independently verified against that company's current published materials, and the disclosed architecture remains an early-stage provisional disclosure that has not been built, tested, or benchmarked.

Credentialed Surfaces (/credentialed-materials)

All 40 steps → (/inventive-steps)

Building surfaces as credentialed agents that participate in the structure's networking and electrical systems.

Provisional application

PRIMARY TECHNICAL DISCLOSURE

- Credentialed Building Materials: Cryptographic Admissibility for Structural Surfaces (/articles/credentialed-building-materials-cryptographic-admissibility-for-structural-surfaces)

SECONDARY TECHNICAL

- Carbon-Sequestration Admissibility Surface (/articles/credentialed-materials/carbon-sequestration-property-surface)
- Composition Rules Governing Surface Interactions (/articles/credentialed-materials/composition-rules)
- Decommissioning And Re-Credentialing Attestation (/articles/credentialed-materials/decommissioning-and-recredentialing)
- Electrical-Distribution Admissibility Surface (/articles/credentialed-materials/distribution-property-surface)
- End-Of-Storage-Life Attestation (/articles/credentialed-materials/end-of-storage-life-attestation)
- Energy-Storage Admissibility Surface (/articles/credentialed-materials/energy-storage-property-surface)
- Lineage Chain Across Material Lifecycle (/articles/credentialed-materials/lineage-chain-across-lifecycle)

- Authority Signatures Block Binding Property Surfaces To Material Identity (/articles/credentialed-materials/master-credential-binding)
- Multi-Authority Signature Block (/articles/credentialed-materials/multi-authority-signature-block)
- Data Network Admissibility Surface (/articles/credentialed-materials/network-property-surface)
- Profile Versioning Continuity (/articles/credentialed-materials/profile-versioning-continuity)
- Structural Admissibility Surface (/articles/credentialed-materials/structural-property-surface)
- Thermal-Property Admissibility Surface (/articles/credentialed-materials/thermal-property-surface)
- Versioned Admissibility Profiles With Lineage Chain (/articles/credentialed-materials/versioned-profiles-with-lineage)
- Water-Coupled Admissibility Surface (/articles/credentialed-materials/water-coupled-property-surface)

APPLICATIONS · GENERAL

- Credentialed Structural Materials for Construction and Civil Infrastructure: Carrying Strength, Mix, and Provenance as Multi-Authority Attestations (/articles/credentialed-materials/construction-and-infrastructure)
- Carbon-Credit-Bearing Building Materials: Sequestration Attestations That Survive Incorporation, Transfer, and Decommissioning (/articles/credentialed-materials/carbon-credit-materials)
- Building-Product Compliance and Code Approval: Property-Surface Profiles as Machine-Evaluable Admissibility Evidence (/articles/credentialed-materials/building-product-compliance)
- Credentialed Building Materials for Real Estate Valuation, Insurance, and Disclosure: A Property History That Binds to the Asset (/articles/credentialed-materials/real-estate-and-asset-lifecycle)
- Recredentialing Recovered Materials: Verifiable Lineage for Reuse and Decommissioning in the Circular Economy (/articles/credentialed-materials/circular-economy-and-decommissioning)
- Energy and Grid-Coupled Surfaces: Crediting Stationary Storage in Structural Mass Without Trusting the Cell (/articles/credentialed-materials/energy-and-grid-surfaces)
- Credentialed Surfaces for Water and Environmental Infrastructure: Signed Performance and Compliance Attestations on Water-Coupled Concrete (/articles/credentialed-materials/water-and-environmental-infrastructure)

APPLICATIONS · SPECIFIC

- Circularise, a blockchain-based supply-chain traceability and digital-product-passport platform for materials vs credentialed material surfaces: attestations bound to the physical material (/articles/credentialed-materials/circularise)

- EC3 (Embodied Carbon in Construction Calculator) by Building Transparency vs a credentialed carbon-sequestration surface bound to the material (/articles/credentialed-materials/ec3-building-transparency)
- **CarbonCure Technologies, which injects and mineralizes CO2 into concrete during mixing vs a credentialed carbon-sequestration attestation architecture (/articles/credentialed-materials/carboncure)**
- Sublime Systems, maker of low-carbon cement via an electrochemical (ambient) process vs a credentialed carbon-sequestration surface bound to the material (/articles/credentialed-materials/sublime-systems)
- Brimstone carbon-negative portland cement vs credentialed material attestations: process decarbonization or per-element carbon accounting? (/articles/credentialed-materials/brimstone)
- The EU Digital Product Passport (DPP) under the Ecodesign for Sustainable Products Regulation (ESPR) vs credentialed surfaces: a data-carrier standard next to a material-bound attestation architecture (/articles/credentialed-materials/eu-digital-product-passport)
- One Click LCA, a life-cycle-assessment and EPD software platform for construction vs a credentialed carbon-sequestration property surface bound to the material (/articles/credentialed-materials/one-click-lca)
- Concrete.ai vs credentialed carbon-sequestration surfaces on structural materials (/articles/credentialed-materials/concrete-ai)

Credentialed Surfaces overview → (/credentialed-materials)