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Carbon-Credit-Bearing Building Materials: Sequestration Attestations That Survive Incorporation, Transfer, and Decommissioning

Biogenic carbon sequestered into concrete, mortar, and surface coatings is real, but the carbon-credit attestation tied to it usually dies at the first material transformation: the moment biochar is mixed into a pour, the moment a wall is repointed, the moment a building is demolished. Buyers are left holding a certificate that no longer maps to any verifiable physical mass, which is precisely the gap that erodes trust in carbon markets. This application is built on the Credentialed Surfaces inventive step, disclosed in U.S. Provisional Application No. 64/050,895, which carries the carbon-sequestration claim as a versioned, signed admissibility surface that migrates with the material through every lifecycle transition. It draws on the same provisional's lineage-chain, multi-authority credentialing, and methane-avoidance attestation primitives.

What This Application Specifies

This application specifies how carbon-credit-bearing building materials carry their sequestration claim as a credentialed property of the physical material, not as a separate paper certificate that travels alongside it. The underlying sequestration is established and not novel: biomass-derived carbon (biochar, turbostratic graphene

produced from organic-waste feedstock, and analogous carbonaceous constituents) is distributed within a structural matrix such as concrete, mortar, or a thin cementitious coating, locking biogenic carbon mass into the built environment. What the Credentialed Surfaces architecture adds, as disclosed in U.S. Provisional Application No. 64/050,895, is a carbon-sequestration admissibility surface: a signed, versioned attestation, bound to the material's credentialed identity, that declares the sequestered carbon mass and the conditions under which a carbon-credit authority will admit it.

In the disclosed architecture, a credentialed structural element carries a profile composed of multiple independently signed property surfaces (structural, thermal, energy storage, fire performance, and carbon sequestration among them). An environmental-credit authority signs the carbon-sequestration surface specifically, distinct from the structural engineer who signs the structural surface and the manufacturer who signs the element's identity. Each surface admits on its own terms, and the multi-authority signature block binds the whole profile to one element. Two primitives from the same provisional do the load-bearing work for carbon accounting. The first is the lineage chain, a persistent record of every credentialed event in the material's life: production, incorporation, in-service re-credentialing, end-of-storage-life, decommissioning, and recycling-grade re-credentialing. The second is the migrating carbon attestation, by which a biogenic carbon-credit attestation moves with the substrate across material flows and across structural lifetimes, each migration being a credentialed transaction signed by an environmental-credit authority and recorded in the lineage chain.

The disclosure also specifies a methane-avoidance attestation for the production stage. Where organic-waste feedstock (source-separated municipal organics, agricultural residue, food-service waste) that would otherwise decompose anaerobically and release methane is instead diverted into carbonaceous material, the producing apparatus signs an attestation declaring the diverted feedstock mass, a feedstock-class methane-emission factor consistent with the displaced disposition pathway, and the resulting

carbon-dioxide-equivalent avoidance. That attestation is bound into the produced material's lineage chain from the start, so the avoidance claim and the sequestration claim originate from the same governed record.

Why It Matters

Carbon markets for the built environment fail at the seams between material states. A removal credit is only as credible as the chain that connects a tonne of claimed carbon dioxide to a specific, verifiable physical mass that still holds it. Conventional registries handle this with documents and serial numbers maintained in a database separate from the material, so the binding between certificate and concrete is an administrative assertion rather than a property of the thing itself. When the material is crushed, blended, repointed, or demolished, the document and the mass drift apart, and double-counting, orphaned credits, and reversal disputes follow.

The harder problem is that building materials are not static. A wall is repointed; a slab gets a topping course; a coating is refreshed; eventually the structure is decommissioned and, ideally, the carbon-rich fraction is recovered and reincorporated. Every one of those events is a material transformation that conventional accounting treats as an endpoint for the original credit. The disclosed architecture treats each instead as a credentialed transition that the attestation survives. Because the carbon-sequestration surface is versioned and the lineage chain is append-only, a registry, an auditor, or a credit buyer can query the current state and the full provenance of a specific structural mass rather than trusting a snapshot taken at issuance. That is what makes the credit durable through the events that ordinarily break it.

This matters most to the parties carrying reversal and verification risk: developers and owners pursuing low-carbon procurement, the environmental-credit authorities and registries that must stand behind issuance, the auditors performing monitoring, reporting, and verification, and the buyers who need assurance the credit will not silently invert when the building is renovated decades later. None of this asserts that

the sequestration chemistry is new. The novelty the provisional claims is the credentialing and admissibility-profile architecture wrapped around materials whose carbon behavior is itself prior art.

How It Composes With the Domain

A carbon-credit-bearing material enters the world with a credentialed identity and an initial profile. At production, the feedstock mass balance and, where applicable, the methane-avoidance attestation are signed and recorded, so the lineage chain begins before the material ever reaches a job site. When the material is incorporated into a pour, a mortar joint, or a surface coating, the incorporation is itself a credentialed event: the carbon-sequestration surface is re-evaluated against the as-placed mass and re-signed at a new version. The version vector gives auditors deterministic ordering, so a later reading never silently overwrites an earlier one; it supersedes it on the record.

Composition rules govern how the carbon surface interacts with the material's other property surfaces. The provisional discloses, for example, a carbonation-tracked rule that adjusts an admissibility surface as a function of cumulative carbonation depth. In this domain that primitive is the natural hook for monitoring permanence: a sequestration surface can be made conditional on durability evidence, so a credit's standing reflects the measured physical state rather than a one-time assumption. Rules are themselves signed and versioned artifacts in a registry, with declared conflict-resolution policy, so the logic that decides whether a credit is currently admissible is auditable in the same way the credit is.

Transfer and aggregation follow from multi-authority credentialing. Because the carbon-sequestration surface is signed by an environmental-credit authority independently of the other surfaces, a credit can be issued, transferred, or extinguished against specific structural mass without disturbing the structural or thermal claims on the same element. The provisional describes exactly this: each cement pour, mortar repointing, and re-credentialing event issuing, transferring, or extinguishing carbon-

credit attestations against specific structural mass. The migrating carbon attestation primitive carries the claim forward when material flows change the substrate, so a repointing that swaps mortar does not orphan the credit; it records a credentialed transition under which the attestation moves to the cumulative composite profile.

Decommissioning and recovery close the loop. End-of-structural-life is a credentialed event signed by a licensed demolition or deconstruction contractor admitted under credentialed scope, producing a demolition-recovery attestation that declares the recovered material's grade, mass, and physical state. If the carbon-rich fraction is recovered and reprocessed, a recycler authority performs recycling-grade re-credentialing and issues a new profile at recovered grade, with the prior lineage intact. The carbon claim is never silently lost at demolition; it either migrates onto the recovered material under a fresh attestation or is explicitly extinguished on the record, and either outcome is a signed entry an auditor can inspect.

What This Enables

The architecture enables carbon accounting that holds across the full material life rather than only at issuance. Concretely, the disclosed primitives support:

- Per-mass credit binding, where an attestation maps to a specific credentialed structural element rather than to a pooled project estimate, narrowing the gap between claimed and physical carbon.
- Survival through incorporation, so biochar or graphene blended into a pour carries its origin attestation (including methane avoidance) into the cured element instead of losing it at mixing.
- Auditable transfer and retirement, where issuing, transferring, or extinguishing a credit against a structural mass is a signed lineage event, reducing the double-counting and orphaned-credit failure modes.

- Renovation-safe accounting, where repointing, recoating, topping-slab augmentation, and other in-service material flows are credentialed transitions the attestation migrates across rather than endpoints that void it.
- Decommissioning attestations and closed-loop recovery, where a demolition-recovery attestation and recycling-grade re-credentialing keep the carbon claim governed when the carbon-rich fraction is recovered and reincorporated.
- Independent multi-party verification, where an environmental-credit authority, an independent testing authority, and a building-code authority each sign their own surface, so a buyer can verify the carbon claim without relying on the manufacturer's word alone.

Across embodiments, the same logic applies whether the carbon-bearing material is a structural concrete element, a non-structural cementitious coating, a precast modular block, or mortar in a joint, and whether the carbon constituent arrives through dedicated production or through a host material's existing manufacturing thermal cycle. The credentialing layer is indifferent to which material carries the carbon; it governs the claim about that carbon.

Boundary Conditions

This is an early-stage provisional disclosure of an architecture, not a built, validated, or benchmarked product. The provisional discloses how a carbon-sequestration claim is credentialed, versioned, composed, and migrated; it does not establish, and this article does not assert, any specific sequestration tonnage, permanence duration, durability figure, or cost. No performance number should be read into this discussion.

The underlying materials science is prior art. Biogenic carbon sequestration in cementitious materials, methane emissions from anaerobic decomposition of organic waste, and carbonation behavior of concrete are established phenomena. Nothing here

claims a new chemistry, bond, phase, or physical effect, and the novelty is located solely in the credentialing and admissibility-profile architecture applied to these materials and to the multi-function-surface category, not in the carbon behavior itself.

The architecture governs claims; it does not by itself measure carbon. The credibility of any issued credit still depends on the quality of the measurement, the integrity of the signing authorities, and the soundness of the feedstock-class emission factors and permanence methodologies that the attestations reference. The disclosed primitives make those inputs auditable and make the resulting claim durable across material transitions; they do not replace the underlying measurement, the registry methodology, or the regulatory determination of what qualifies as a credit. Real-world carbon-market rules, registry protocols, and any specific standard or program named for context are external frameworks, and admissibility under them is a function of those frameworks, not of this disclosure.

Disclosure Scope

The technology described here, the carbon-sequestration admissibility surface, the lineage chain, multi-authority credentialing, composition rules, the methane-avoidance attestation, and the migrating carbon attestation, is disclosed in U.S. Provisional Application No. 64/050,895 as part of the Credentialed Surfaces inventive step. The carbon-market context, the monitoring-reporting-verification problem, the deployment scenarios, and the parties who benefit are described as external domain framing to show an enabling application of the disclosed architecture; they are not themselves patent claims, and references to carbon registries, regulatory programs, or accounting standards are illustrative context, not assertions of compliance or endorsement. Any underlying materials behavior referenced is prior art; the disclosure's novelty lies in the credentialing architecture applied to physical building materials, not in the sequestration chemistry. This article is explanatory and does not define the scope of any claim, which is determined by the application and any patents issuing from it.

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)

Credentialed Surfaces overview → (/credentialed-materials)