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Energy-Storage Admissibility Surface

The energy storage admissibility surface is the credentialed property surface by which a structural element's storage capability participates in the building's electrical system. It declares storage capacity, power capacity, cycle count, calendar age, round-trip efficiency, fault history, and degradation indicators, signed by a utility or building-code authority. The surface admits the credentialed structural element to building-energy-management aggregation and to pair-settled direct grid services under credentialed, signed properties rather than asserted figures. Because realized storage capacity degrades with cycling, calendar age, and environmental state, the surface is updated through state-of-health attestations recorded in the lineage chain, which preserves prior values for audit. This document discloses the surface, how it is bound and aggregated, how it composes with adjacent primitives, how it is distinguished from device-mode storage, and the intended scope of disclosure.

Surface Specification

The energy storage admissibility surface is one of the plurality of admissibility surfaces that compose a credentialed structural element's admissibility profile. Like the structural, thermal, fire-performance, and carbon-sequestration surfaces, it is independently credentialed by an authority with declared scope. For the storage

surface, the disclosure names a utility or building-code authority. The surface declares property-specific parameters and admission conditions for the energy storage property category, and it composes with the other surfaces through declared composition rules.

The realized values carried for the surface are recorded through state-of-health attestations signed by the building energy management system's attestation module. A state-of-health attestation declares the realized storage capacity, power capacity, cycle count, calendar age, round-trip efficiency, fault history, and degradation indicators of the credentialed element. Realized cycle life and calendar life are declared in the credentialed admissibility profile and, as the disclosure notes, are coupled to the structural matrix's mechanical, hydration, carbonation, freeze-thaw, and thermal-cycling state rather than to an idealized capacitor cycle life.

The surface is bound to the credentialed structural element through the authority signatures block of the admissibility profile, which binds the entire profile to the element's identity. Downstream evaluation of the surface, by the building energy management system or by a building-code or utility authority, proceeds against the composed admissibility profile so that the storage property is admitted only in composition with the element's other credentialed surfaces.

Aggregation And Dispatch

The energy storage admissibility surface is consumed by the building energy management system, which discovers structural-storage capacity distributed across structural elements, characterizes admissibility, aggregates the distributed capacity into a coherent storage resource, evaluates credentialed access through composite admissibility evaluation, and dispatches energy to credentialed loads through governed actuator execution. The aggregation module computes the coherent storage resource as the sum of constituent element capacities weighted by current state-of-health and

adjusted for constraints arising from multi-element coordination. The dispatch module operates individual structural-storage elements consistent with the access-evaluation determination and records each dispatch event in the lineage chain.

The storage surface does not act alone during operation. It composes with the element's other surfaces through signed, versioned composition rules held in a composition-rule registry. Representative composition rules in the disclosure include a fire-event rule reducing storage admissibility to zero when the fire-performance surface declares fire-event detection, a thermal-runaway prevention rule constraining storage dispatch during high thermal-surface readings, a structural-load-versus-storage-cycle rule reducing storage admissibility when the structural surface reports fatigue accumulation above a declared threshold, a wet-environment storage rule requiring current water-coupled attestations before admitting storage operations near wet surfaces, a freeze-thaw-derated capacity rule, and a carbonation-tracked-state-of-health rule. These rules operate on the storage admissibility surface as functions of the structural and environmental surfaces.

For grid participation, the building energy management system issues duration-attested commitments to grid-service authorities. The duration attestations declare kWh-over-time profiles with declared reliability, signed by the system's credentialed identity, and are matched-pair-settled per the matched-pair settlement primitive of the Spatial Mesh Application. The disclosure distinguishes a duration-attested commitment from amperage-rated capacity participation in that the substrate's offer to the grid is provable kWh-over-time rather than instantaneous power, with the substrate's chemistry class governing the available duration profile.

Re-credentialing And State Of Health

Realized storage capacity declines with cycling, with calendar age, and with the structural matrix's environmental state. The state-of-health attestation primitive records the realized cycle life, capacity, power capacity, calendar age, round-trip

efficiency, fault history, and degradation indicators as observed by the building energy management system, and the credentialed admissibility profile is updated accordingly. The lineage chain preserves the record across the element's service life so that the trajectory of capacity decline is auditable.

The disclosure defines an end-of-storage-life transition as a credentialed event in which the realized energy storage capacity has degraded below a declared threshold. At that transition the credentialed admissibility profile is updated to reflect zero or reduced storage capacity, while the structural admissibility surface continues to support the element's structural function. End-of-storage-life of the original substrate composition does not require demolition of the structural element.

The architecture further admits continuous re-credentialing across operational material flows during the element's in-service lifetime, including mortar-joint replacement, surface-coating refresh, cavity-fill replacement, and substrate top-up. Each material flow is a credentialed event signed by an installer authority and recorded in the lineage chain, and the composite admissibility profile is re-evaluated against the cumulative material flow rather than only at original installation. Under this metabolic-lifetime model, incoming material flows refresh, augment, or substitute the storage substrate while the element's credentialed identity persists. At end of structural life, recycling-grade re-credentialing is performed by a recycler authority and recorded in the lineage chain.

Composition With Adjacent Primitives

The energy storage surface composes with the authority signatures block of the admissibility profile, which binds the entire profile, the storage surface among the plurality of surfaces, to the credentialed structural element's identity. It composes with the duration-attested grid-commitment function: the building energy management system's duration-attested commitments to grid-service authorities are backed by storage whose realized capacity, power, and cycle life are carried on the storage surface

and weighted by current state-of-health. It composes with the lineage chain, which records dispatch events, state-of-health attestations, and re-credentialing events so that the trajectory of capacity decline is auditable across the service life of the material. And it composes with the structural, thermal, and fire-performance surfaces under signed composition rules, which together define the composite admissibility envelope of the credentialed structural element when its storage capability is operated in a load-bearing element.

Distinction Over Prior Art

The disclosure characterizes existing energy storage as a property of dedicated devices: batteries, capacitors, flywheels, pumped-hydro reservoirs, hydrogen tanks, and compressed-air vessels are engineered as discrete devices whose function is to store energy, and existing building energy management systems treat installed batteries as discrete connected loads or sources. Existing structural-battery research treats structural integration as embedding a battery device into a host material rather than as a property of the host material. None of the existing building codes recognize energy storage as a material property of structural building components.

The architectural inversion disclosed here treats energy storage as a credentialed property of structural building materials rather than of dedicated devices, and the energy storage admissibility surface is the credential by which that property is expressed. The disclosure identifies three properties that distinguish it from prior structural-battery research operating jointly: the primary engineering objective is structural, with storage a credentialed property of the structural matrix; the storage capability is one surface among a plurality of independently credentialed property surfaces composing through declared composition rules; and the building electrical system, rather than per-element power electronics, is the aggregation primitive. The surface is bound to the specific element through the authority signatures block and the

lineage chain, is updated through state-of-health attestations with prior values preserved for audit, and backs duration-attested commitments settled through pair-settled direct grid services rather than amperage-rated capacity participation.

Disclosure Scope

This material is supported by U.S. Provisional Application No. 64/050,895. The disclosure contemplates a credentialed energy storage admissibility surface declaring storage capacity, power capacity, cycle count, calendar age, round-trip efficiency, fault history, and degradation indicators for a credentialed structural element; binding of the surface to the element through the authority signatures block of the admissibility profile and the lineage chain; aggregation and dispatch of distributed structural storage by a building energy management system through composite admissibility evaluation, with dispatch events recorded in the lineage chain; composition of the storage surface with the structural, thermal, and fire-performance surfaces under signed, versioned composition rules; updating of the surface through state-of-health attestations, continuous re-credentialing across material flows signed by an installer authority, and recycling-grade re-credentialing by a recycler authority; and duration-attested grid-commitment participation settled through pair-settled direct settlement. The storage surface is credentialed by a utility or building-code authority and is not limited to a particular storage chemistry or form factor.

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

- credentialed-materials/carbon-sequestration-property-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)
- credentialed-materials/end-of-storage-life-attestation (/articles/credentialed-materials/end-of-storage-life-attestation)
- **credentialed-materials/energy-storage-property-surface (/articles/credentialed-materials/energy-storage-property-surface)**
- Lineage Chain Across Material Lifecycle (/articles/credentialed-materials/lineage-chain-across-lifecycle)
- Master Credential Signature Binding All Property Surfaces (/articles/credentialed-materials/master-credential-binding)
- Multi-Authority Signature Block (/articles/credentialed-materials/multi-authority-signature-block)
- Data-Networking Admissibility Surface (/articles/credentialed-materials/network-property-surface)
- Profile Versioning Continuity (/articles/credentialed-materials/profile-versioning-continuity)
- credentialed-materials/structural-property-surface (/articles/credentialed-materials/structural-property-surface)
- credentialed-materials/thermal-property-surface (/articles/credentialed-materials/thermal-property-surface)
- Versioned Admissibility Profiles With Lineage Chain (/articles/credentialed-materials/versioned-profiles-with-lineage)
- credentialed-materials/water-coupled-property-surface (/articles/credentialed-materials/water-coupled-property-surface)

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