

# AQUEOUS SiO<sub>2</sub>–SILANE HYBRID MICRO-LAYER FOR AIRCRAFT EXTERIORS — FAQ

Clean Engineered Chemistry — Zero Gimmicks

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## 1. What is this SiO<sub>2</sub>–silane hybrid micro-layer?

It is a **water-based, inorganic SiO<sub>2</sub>–silane hybrid surface technology** designed for **aircraft exterior aluminum skins and compatible painted topcoats**.

The system forms a **sub-micron, non-film-forming micro-layer** that chemically bonds to aluminum oxide surfaces, improving durability, soil release, and environmental resistance without adding measurable thickness or weight.

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## 2. Is this a coating or a surface treatment?

It is a **surface-engineered micro-layer**, not a conventional coating.

Unlike topcoats or films, it:

- does not build thickness
- does not change geometry
- does not peel, crack, or delaminate
- integrates at the surface chemistry level

It functions as a **surface conditioner**, not a structural or decorative coating.

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### 3. How does the micro-layer bond to aircraft aluminum?

Aircraft aluminum naturally forms an **Al<sub>2</sub>O<sub>3</sub> oxide layer**.

The SiO<sub>2</sub>-silane system bonds through:

- Si-O-Al covalent linkages
- silanol-metal oxide hydrogen bonding
- siloxane network condensation
- inorganic-organic crosslinking

This creates a **chemically anchored hybrid network** at the surface rather than a mechanically adhered film.

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### 4. What materials does this system work on?

The micro-layer is engineered for:

- bare aircraft aluminum alloys (e.g., 2024, 6061, 7075)
- aluminum skins with compatible polyurethane topcoats
- painted exterior surfaces commonly found on commercial and private aircraft

It is not intended to replace certified structural coatings.

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### 5. How thick is the applied layer?

The applied micro-layer is **less than 1 micrometer (<1 μm)** in thickness.

There is:

- no measurable buildup
- no aerodynamic penalty
- no weight increase

Performance is achieved through **chemistry and structure**, not thickness.

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## 6. What performance benefits does the micro-layer provide?

The bonded hybrid layer provides:

- hydrophobic behavior and water shedding
  - reduced soil, soot, oil, and bug adhesion
  - improved cleanability
  - resistance to rain erosion
  - resistance to de-icing fluids
  - resistance to jet fuel mist and exhaust contaminants
  - reduced UV-driven paint oxidation
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## 7. Does this system affect aircraft aerodynamics?

No.

Because the micro-layer is:

- sub-micron
- non-film-forming
- conformal to the surface

It does **not alter surface geometry or airflow**.

Any aerodynamic benefit comes indirectly from **reduced surface contamination**, not shape change.

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## 8. How is this different from ceramic coatings or waxes?

Conventional ceramic coatings and waxes are:

- solvent-based
- film-forming
- thickness-dependent
- not aluminum-specific
- not designed for aviation MRO workflows

This system is:

- water-based
  - non-film-forming
  - chemically bonded to aluminum oxide
  - designed specifically for aircraft maintenance environments
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## 9. Is this a replacement for polyurethane topcoats?

No.

This system:

- is not a topcoat
- is not structural
- does not replace certified paint systems

It functions as a **surface conditioning layer** applied on top of existing finishes to improve durability and maintenance performance.

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## 10. Does this require special equipment or curing?

No.

Application advantages include:

- water-based formulation
  - ambient-temperature application
  - no ovens or UV curing
  - no specialized deposition equipment
  - compatibility with existing MRO processes
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## 11. Is this compatible with MRO workflows?

Yes.

The system is designed to:

- integrate into routine exterior maintenance
  - fit within existing cleaning and surface-conditioning steps
  - avoid downtime or specialized infrastructure
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## 12. Is this a regulated structural modification?

No.

The micro-layer:

- does not change structure
- does not add thickness
- does not alter materials of record

It is applied as a **surface conditioner**, not as a certified structural coating.

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## 13. How long does the micro-layer last?

The system is **sacrificial by design**.

- It wears gradually over service cycles
- It does not fail catastrophically
- It can be reapplied as part of routine maintenance

Longevity depends on exposure, cleaning frequency, and operational environment.

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## 14. What markets does this technology address?

Primary markets include:

- commercial airline exterior maintenance
  - regional and cargo fleets
  - private and business aviation
  - MRO surface-conditioning services
  - aviation detailing operations
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## 15. How large is the market opportunity?

Based on aviation coatings, MRO, and surface-maintenance data:

- Total addressable market (TAM): **\$6–8B annually**
- Serviceable available market (SAM): **\$4–5B annually**
- Conservative serviceable obtainable market (SOM): **\$150–300M annually** over 3–5 years

This is a **high-margin, recurring-use** surface-conditioning segment.

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## 16. Do competitors offer similar technology?

No.

Existing solutions include:

- polyurethane and fluoropolymer topcoats
- silicone waxes
- solvent-borne ceramic detail coatings

No competitor offers:

- a water-based SiO<sub>2</sub>-silane hybrid
  - a non-film-forming inorganic micro-layer
  - aluminum-oxide-specific chemical bonding
  - an MRO-friendly surface-conditioning system
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## 17. Is this technology protected by patents?

Yes.

The underlying SiO<sub>2</sub> platform claims include:

- aqueous SiO<sub>2</sub> dispersions
- silane crosslinkers and adhesion promoters
- inorganic hybrid micro-layers
- application to metals, plastics, composites, and painted substrates
- methods of forming bonded silica networks

Aluminum surfaces fall within the platform's **metal-oxide substrate coverage**.

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## 18. Why hasn't this existed before?

Most aviation surface technologies evolved around:

- thick coatings
- solvent chemistry
- decorative or structural paint systems

This system introduces a **different architectural approach**:

**surface chemistry without coating thickness**

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## 19. What is the key takeaway?

This SiO<sub>2</sub>-silane hybrid micro-layer introduces a **new category of aviation surface conditioning**:

- water-based
- non-film-forming
- aluminum-oxide bonded
- MRO-compatible
- scalable and repeatable

All delivered through **clean engineered chemistry — zero gimmicks.**

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