Lotus Leaf Coatings We solve difficult cleaning problems for our customers



Technology Introduction and Benchmarking Data

Increasing Utility Production for PV Solar

Problem: Soiling is a Recognized Problem in PV Solar

Utility Scale Loss can be up to 20% annually depending on location Est. \$4B in losses due in soiling by 2022

Solution: HydroPhil – Anti-Soiling

Increase energy output by 3% and more Reduces Cleaning Cycles & Protects PV Modules Applied in the Field or in the Factory



HydroPhil Super Hydrophilics



HydroPhil is a proprietary ultrathin material with superior hydrophilic, water loving properties

WATER ATTRACTION

Unique surface structure which attracts water to the surface (contact angle < 10°) OPTICAL CLARITY

Low haze and high optical clarity due to thickness and surface structure UV STABLE

• Stable under ambient ultraviolet exposure

DURABILITY

• Exhibits high mechanical, chemical & environmental durability COATING METHODS

• Dip, spin, spray, curtain

HydroPhil Anti-Soiling Coating

Tunable Surface Energy

• Anti-soling via the sheeting effect (affinity for water)

Sub-Nanometer Porosity

- Minimal surface stress in moist environments
- Coating < 50 nm which increases durability

UV Stable

- As compared to polymer and silane based coatings
- Maintains properties after QUV weathering

Anti-Reflective (A/R) Compatible

• Bonds to Anti-Reflective Coatings

Seals porous Sol-Gel AR coatings

• Improves mechanical, chemical & environmental durability

HydroPhil Core Technology Differentiators

Parameter	Lotus Leaf Hydrophil Coating	Competitive Hydrophilic Competition	
Surface Energy	Tunable via Chemistry	Fixed by Material	
Bonding Strength	Strong Surface Bonds to Glass and AR Coatings	Weak Surface Bonds to Glass and Base Layer Materials	
Optical Clarity	Excellent - Sub-Nanometer Scale and Low Index of Refraction	Good – Nanometer Scale and Medium Index of Refraction	
UV Stability	Excellent – Inorganic Solution	Weak - Organic Polymer Solutions	
Coating Stability	Off-Line Synthesis	On-Line Synthesis (Traditional SiO ₂ Sol Gel)	

Anti-Soiling Coating Performance



Dust Test Conditions

- 100g ISO Medium Test Dust applied to glass at 45° angle with sifter for even deposition
- Tap sample to remove loose dust
- Visual Inspection with Transmission & Haze Measurement

Competitive Benchmarking (Glass)

Attributes	HydroPhil	Commercial Hydrophilic Coating	Commercial Fluoroalkylsilane
Initial Contact Angle	10°	17°	104°
Index of Refraction	1.47	1.46*	1.35*
Transmission (%) **	Up to 94.6 ***	88.6	89.2
Transmitted Haze (%)	<0.1	1.54	<0.1
Base Exposure (CA after 24h @pH 9)	10°	23°	90°
Acid Exposure (CA after 24h @pH1)	19°	15°	91°
Boiling H ₂ O (CA after 30 minutes)	13°	38°	98°
Mechanical Wear (CA after 1000 CC rubs)	12°	30°	78°

* Published Data ** Uncoated baseline Transmission 88.9% ***Subject to coating thickness

HydroPhil AS Before & After Soiling



Soiling Performance on A/R Coatings



Anti-Soiling Coating Performance



Mechanical Durability Benchmark



Water Durability Benchmark



Thank You

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