“Working from Home” Webinar Series: Hydrophilic Surface Treatments

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THANK YOU FOR JOINING US

Presenters

- Edward Hughes CEO
- Eric Bruner PhD President & Founder
- Mario Gattuso Sr. Business Development Mgr.

Logistical

- Recorded
- Ask questions via GoToMeeting question tab

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OUR GOAL

Aculon enables customers to make better products

by being an innovative, responsive and fast

developer and producer

of best in class

surface modification technologies.

Together we create winning products!

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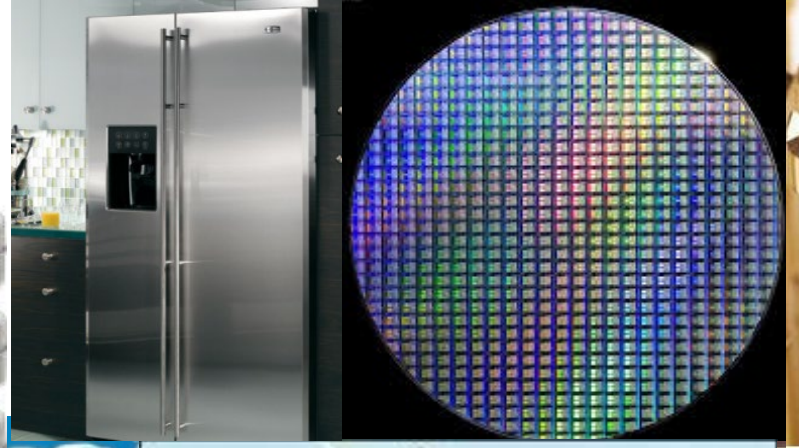
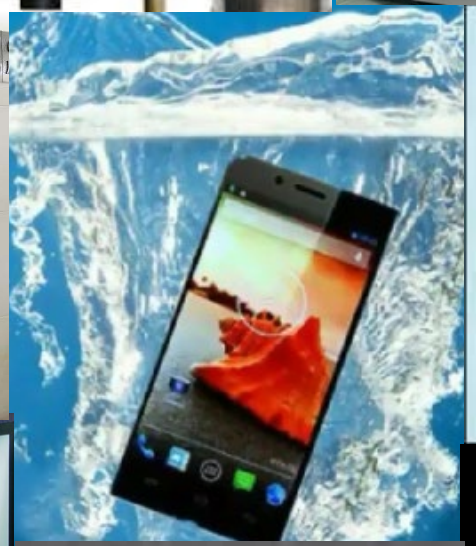
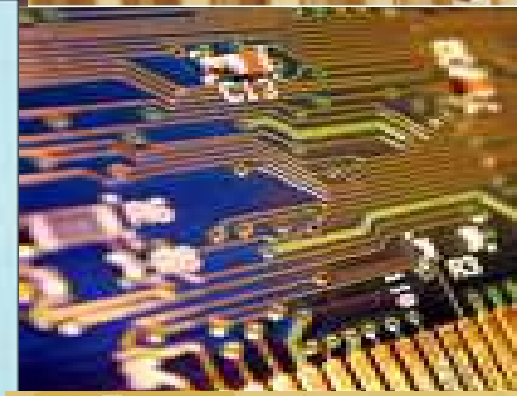
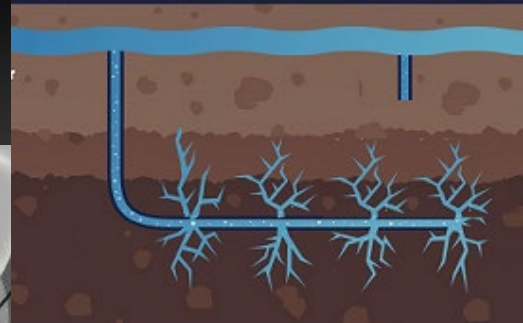
AGENDA

- Aculon Overview
- Technology Platforms
- Surface Modification Options
- Hydrophilic Applications
  - Electronics
  - Oil & Gas
  - Specialty
- Lab Services
- Q&A





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ACULON OVERVIEW

Founded 2004

- **Expertise** Develop & produce surface solutions to modify a broad variety of surfaces (metals, glass, polymers).
- **Functionality** Hydrophobic, superhydrophobic, oleophobic, hydrophilic, anti-fingerprinting, adhesion promotion
- **Treatments** Thin, easy to apply (no vacuum chambers), often no cure, safe, non-toxic and offer green options.
- **Differentiation** Create proprietary innovative treatments & willingness to work with customer to solve problems.
- **Focus areas** Electronics, Oil & Gas, Specialty (Medical +other)
- **Business Model** Produce chemistry & treat parts
- **IP** Over 37 Patents granted. Worked with 1000's applications, invested 100,000's hours
- **Products:** > 100
- **People:** Smart (numerous Chemists with PhD's & Masters Degrees, Electrical & Mechanical Engineers)
- **Global** Locations San Diego (HQ, Lab & Manufacturing) Shanghai, Singapore, Dallas, Amsterdam,
  Distributors > 12 in Asia

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WHY HYDROPHILIC SURFACES MATTER?

Interaction with surfaces can create problems.
Hydrophilic technologies can be used to address a wide variety of problems.
Examples include:

1. Functional issue due to liquid behavior on surface
2. Surface contamination (fingerprints) degrades a products aesthetic behavior
3. Water droplets/contamination impede optical performance
4. Water droplets result in optical issues on lenses and camera domes
5. Surface is not lubricous enough
6. Wettability of a surface or powder is not ideal
7. Desire to prevent bubble formation underwater

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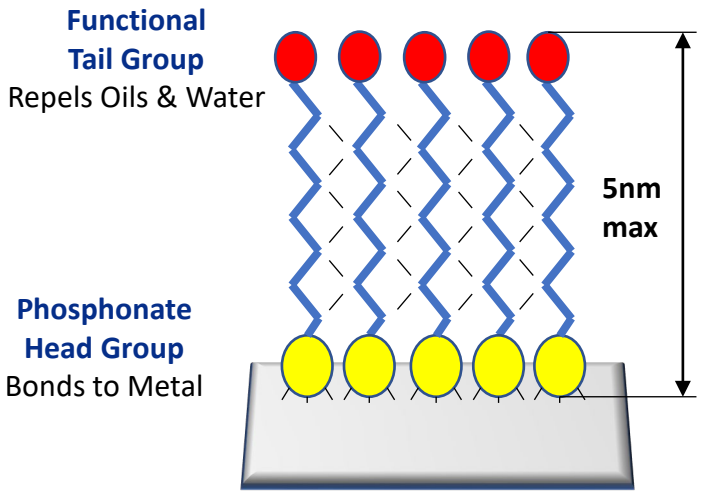
ORIGINAL TECHNOLOGY

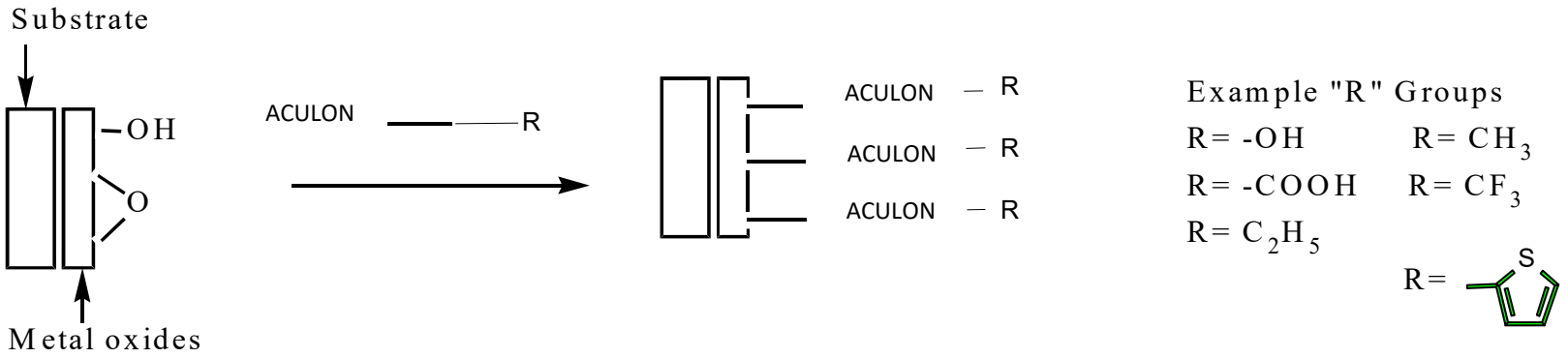
Aculon's proprietary "Self Assembled Monolayer of Phosphonates" (SAMP) can treat surfaces to impart wettability.

The SAMP monoloayer is comprised of a phosphonic acid and a repellent, carbon-based molecule:

1. Phosphonic acid reacts with the surface and creates a covalent bond at the substrate: phosphonic acid interface
2. The carbon group connected to the phosphonic acid is the functional mono layer
3. The monolayer is less than 5 nanometers thick



VERSATILE TECHNOLOGY



TAILOR THE "R" GROUP STRATEGY

"Hook"

- Strong Chemical Bonds – Resistant to Abrasion
- Chemically Resistant – Stable as the Underlying Substrate
- Thermally-Stable – up to 175-250˚C in ambient air.

"Tail"

- Surface Functionality – Lubricity, Cleanability, Surface Energy
- Interfacial Functionality – Reactivity, Adhesion of Polymers

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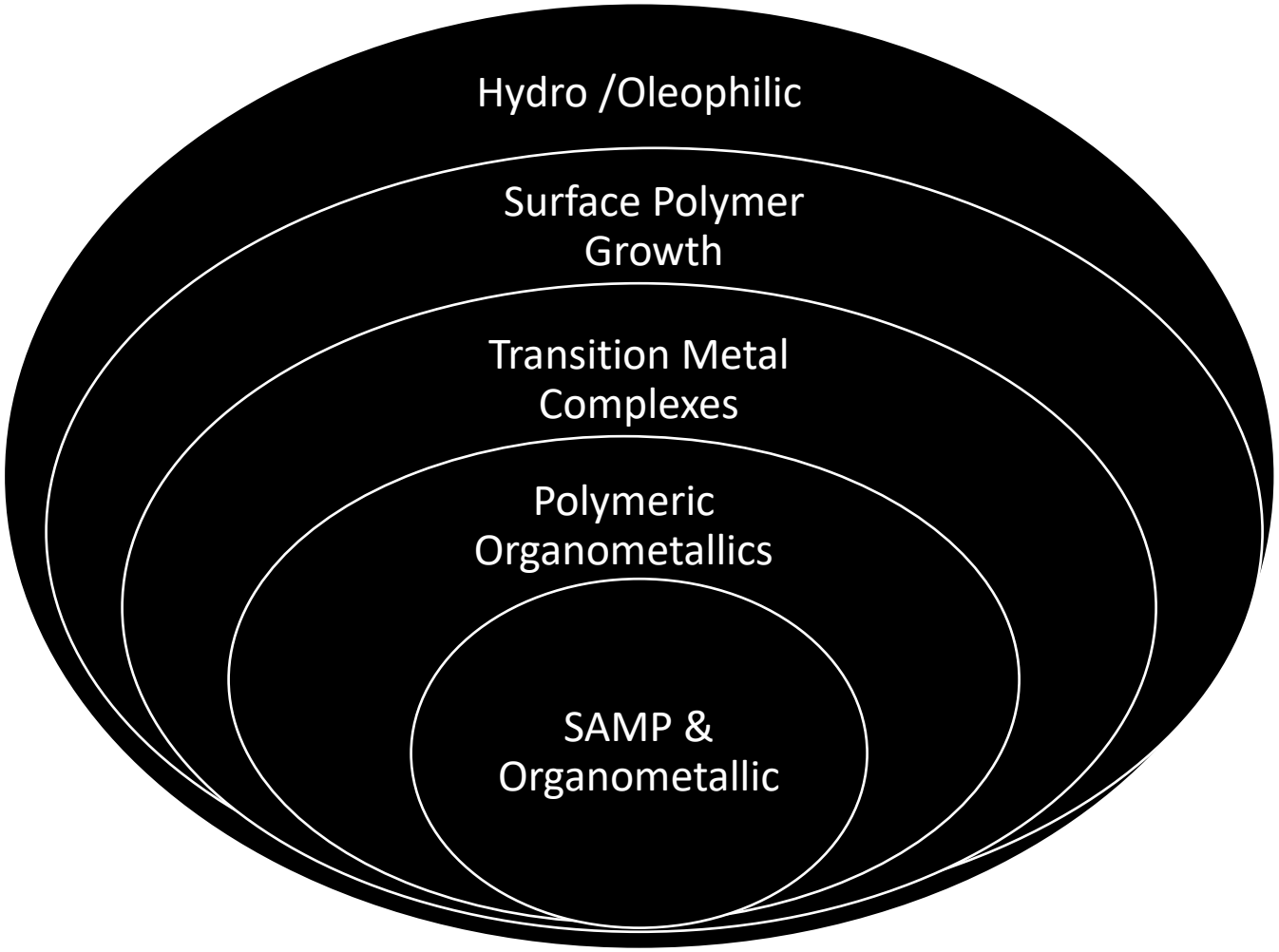
MANY SURFACE MODIFICATION PLATFORMS



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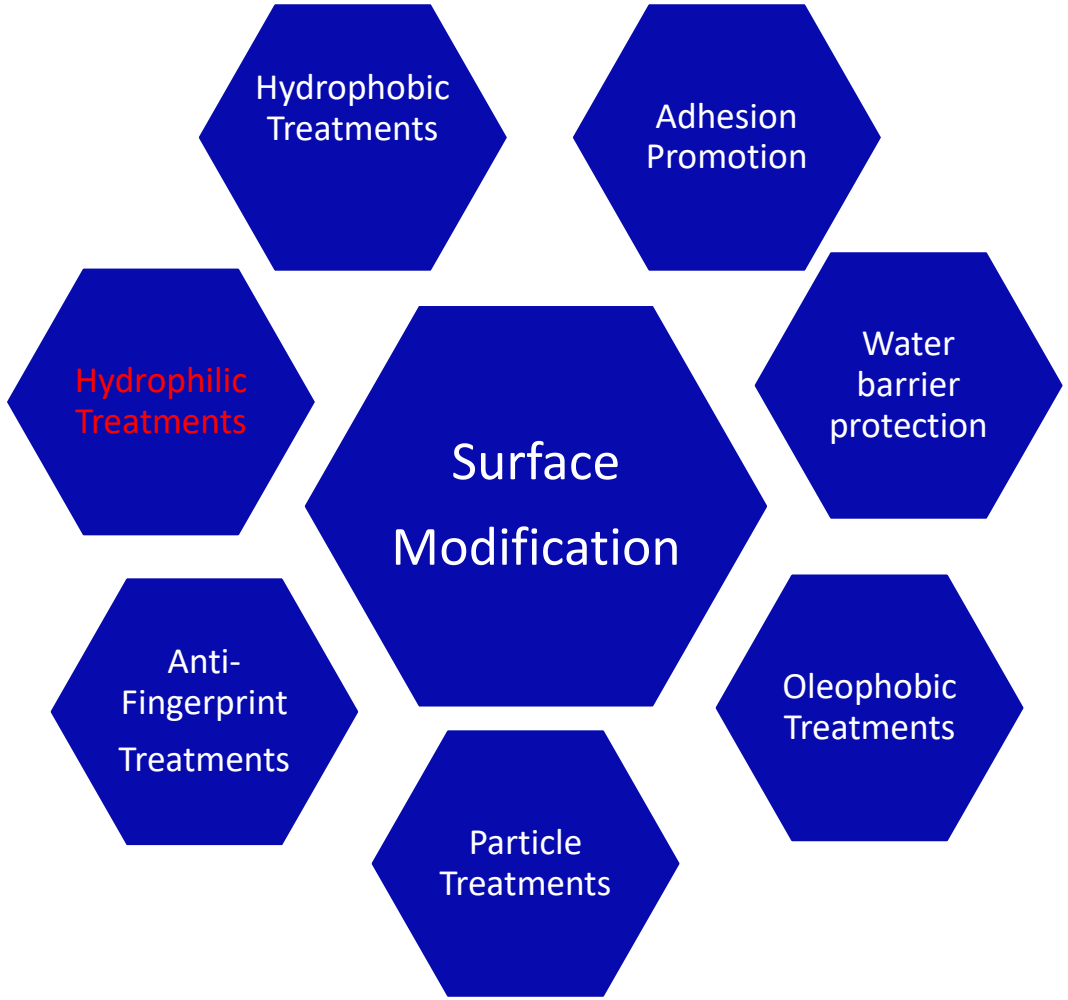
EXPERTISE AND PLATFORMS



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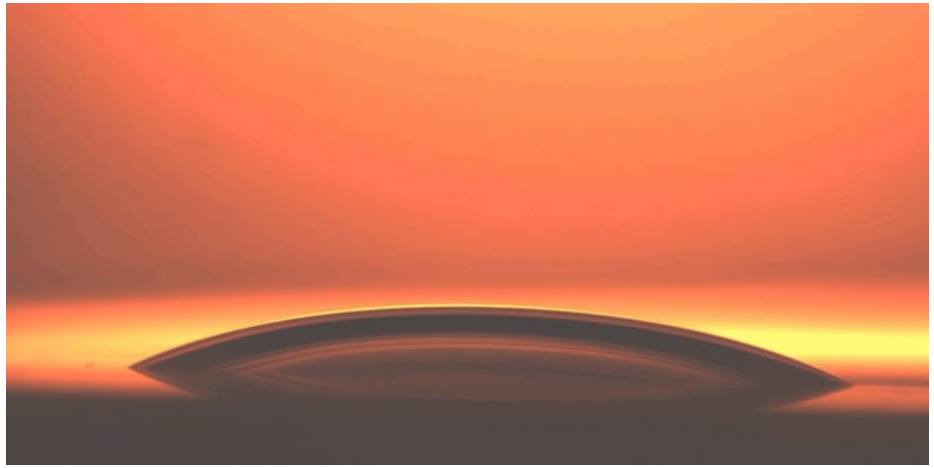
HYDROPHILIC SURFACE TREATMENTS

Variety of surface modification technologies capable of functionalizing numerous substrate types to be hydrophilic:

- **Water attracting**
  - Water wets and spreads uniformly
  - Increases surface energy
  - Hydrophilic WCA <10°
- **Optically Clear**
  - Ultra-thin and optically clear coatings leave surface appearance and feel intact
- **Flexible**
  - Coat nearly any substrate type: metal, glass, ceramics, polymers, etc
- **Broad Application Base**
  - Broad variety of applications/industries benefit from water attracting surfaces



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SUBSTRATE & CHEMISTRY MATCHING

The substrate in question needing hydrophilic modification will drive the options available:

Metals & Oxide Containing Surfaces
(Ceramics/Semiconductors/Glass)

- TMCs
- Surface Growth Polymers
- Polymeric Organometallics

Polymeric (non-oxide) Surfaces

- TMCs
- Surface Growth Polymers
- Polymeric Organometallics

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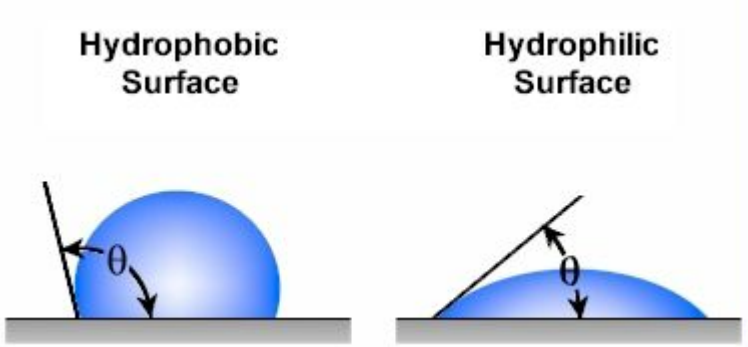
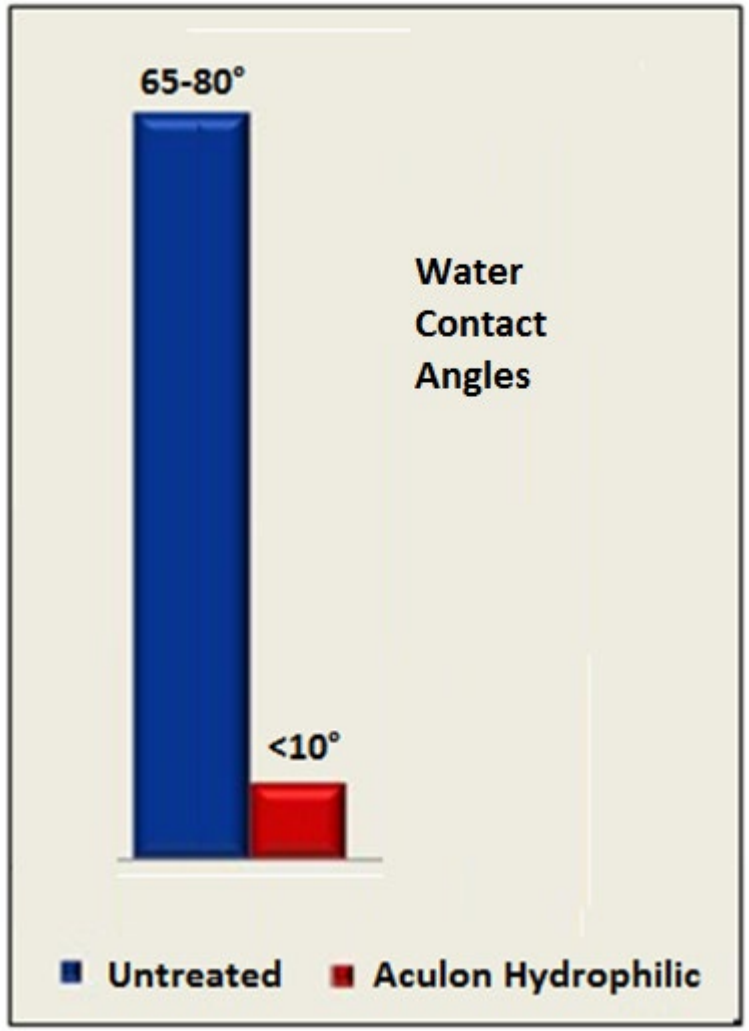
HYDROPHILIC PERFORMANCE

CONTACT ANGLE



Conclusion: "Aculon's hydrophilic treatment results in water contact angles that are low and consistent"



HYDROPHILIC DURABILITY

Treatments are chemically robust with options that can withstand most any environment or exposure condition:

- **Thermal Stability**
  - Thermally stable in ambient air
  - 200-300°C depending on technology type
- **Abrasion Resistance**
  - Variety of options with different levels of durability and abrasion resistance depending on your exposure conditions and longevity requirements
- **Chemical Stability**
  - Resistant to nearly any chemical depending on substrate and technology type
- **UV**
  - UV stable options available

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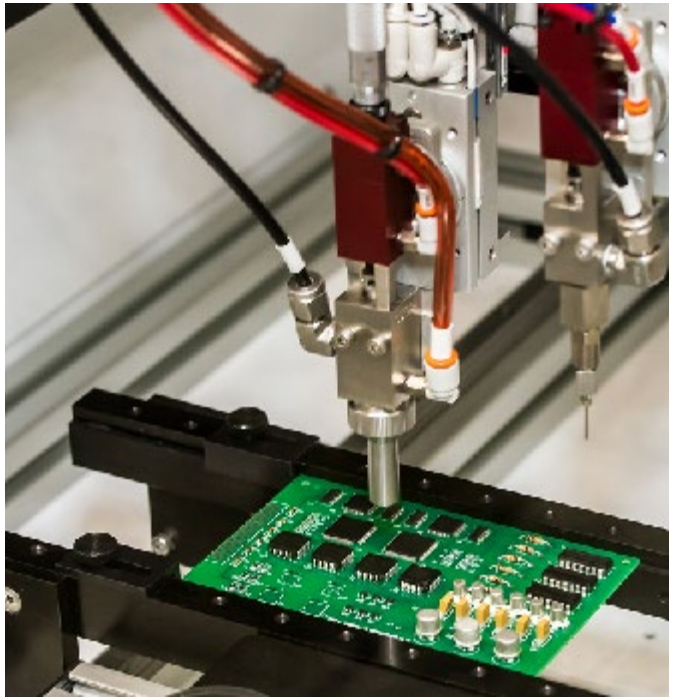
APPLICATION PROCESS

Hydrophilic treatments are robust and scalable for high volume commercial applications. Treatments are all applied via wet chemical processes, meaning no deposition equipment, chambers, or batch processing, ever! Application process depends on the application specifics but can include:

- Dip Applied
- Dispense
- Flow Coat
- Spray Application



Parameters:

- Concentrations
- Solvent
- Coverage
- Temperature
- Cure

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ACULON FOCUSES

1. Electronics

2. Oil & Gas

3. Specialty

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ELECTRONICS

Hydrophilic Applications include:

- **Anti-Fingerprinting** Laptop / tablets, Appliances, Packaging
  - Aculon offers several easy clean and Anti-Fingerprint (AFP) treatments for electronics and other applications

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AFP COATINGS

What approach can be utilized to tackle the issue of fingerprinting?

Surface Treatments & Coatings:

- **Anti-fingerprint (AFP) – Focus on Hiding Power**
  - **Hiding of initial fingerprint by tuning surface energy.**
- Easy-Clean (EC)
  - Easy removal of Oils with Oleophobic coatings >75°

Texture: Gloss or Matte Finish

- Through increased roughness a matte finish is created which hides the Fingerprint through diffuse reflectance.
  - The surface roughness will drive the type of AFP coating that is an ideal match to maximize performance.

Color: Light Absorption of Surface

Lighter Colored Substrates Reflect More light and are Less Sensitive to Light Absorption by Smudge

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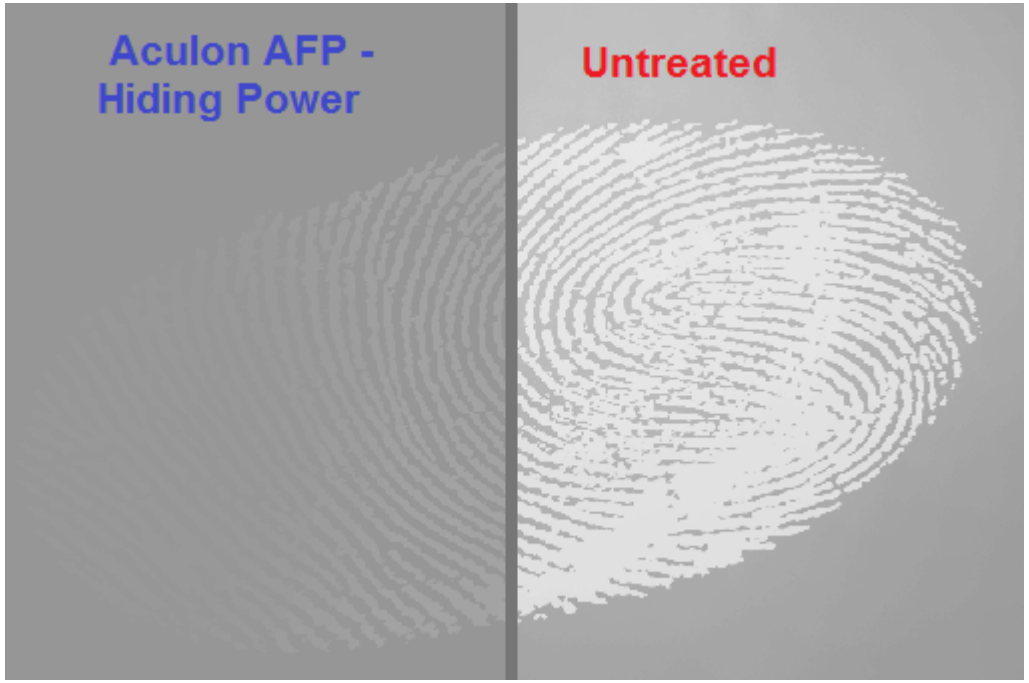
AFP COATINGS – HIDING POWER

Extremely thin optically clear AFP – Hiding Power treatments are applied to the surface which:

- **Hide the oil of the fingerprint**
  - Allow light to pass, significantly reducing its appearance
- **Offer Easy Clean Properties**
  - Hydrophobic behavior assists with making it easier to clean fingerprints without chemicals
- **Durable**
  - Robust coatings offer ongoing AFP performance after normal handling



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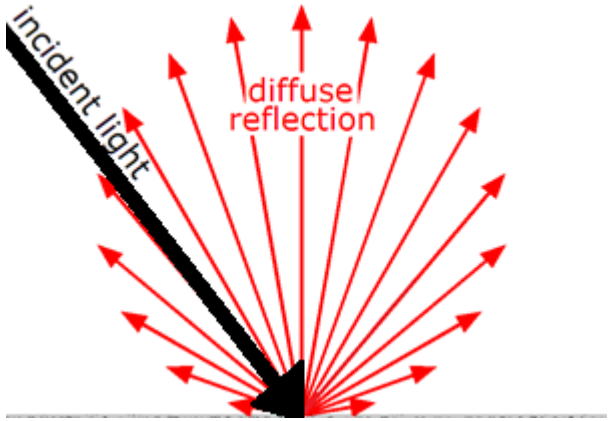
AFP COATINGS – TEXTURE

By better understanding the impacts of texture on fingerprint behavior it can be used to your advantage

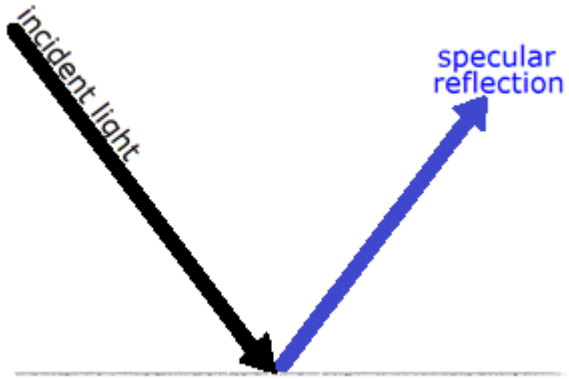
Matte Finish

- Results in diffuse reflection
- Helps to hide appearance of fingerprints



Glossy Finish

- Results in specular reflection
- Maximizes appearance of fingerprints



How to Leverage

- Increase matte level to further hide fingerprints
- Adjust surface texture in parallel with AFP Coatings to maximize desired performance
- Utilize knowledge of viewing angle impacts to your advantage

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AFP COATINGS – COLOR

Color impacts the substrates native fingerprint Hiding power

- Darker colors tend to show a higher level of fingerprinting than light
  - Benefit from treatments focusing on Hiding Power
- Light colors naturally do a better job of hiding fingerprints due to high reflectivity
  - Lighter colors tend to benefit more from treatments with focus on ease of cleaning
- **Different colors may require individual solutions where all else remains the same!**

Black- High

Dark Grey – Medium/High

Blue – Medium

Silver – Low

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OIL & GAS

APPLICATIONS

Anti Fouling:

- Oil spill containment booms & equipment

Anti Fog

- Hydrophilic Treatments improve anti fog behavior of optical applications utilized in the oil & gas industry

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ANTI FOULING APPLICATIONS

Functionalizing industrial parts to be hydrophilic can significantly improve anti fouling performance for numerous applications:

- **Oil Containment Booms**
  - Oil containment booms and equipment are less prone to fouling and easier to clean after removal from the field when Aculon Hydrophilic Treatment has been applied

- **Durable**
  - Extremely robust coatings survive the most aggressive environments

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SPECIALTY

Applications

- Medical
- Anti-fog
- Bubble Repellency

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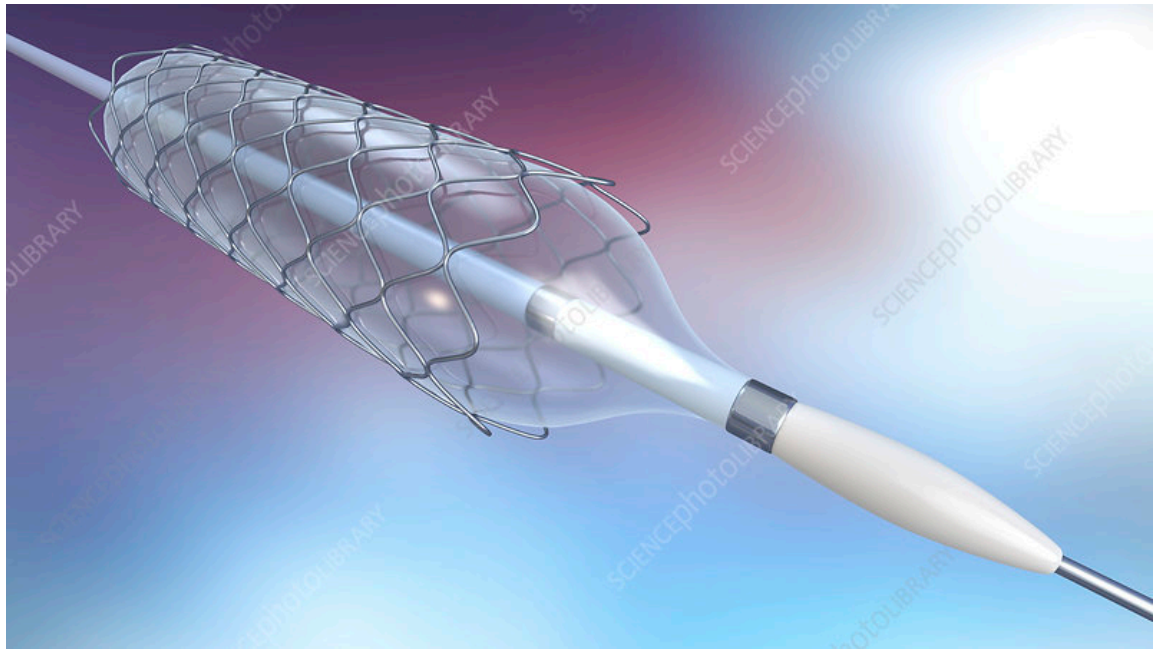
MEDICAL DEVICES

Aculon's hydrophilic surface treatments can functionalize a wide variety of substrates to drastically increase lubricity effectively reducing the coefficient of friction of the surface.

- **Common Applications**
  - Capillaries/catheters benefit from a lubricious hydrophilic coating where friction has negative consequences
  - Lubricious coatings are beneficial for applications where prevention of protein & blood bonding to the surface is desired.
  - Improve wettability of biological fluoids on polymers used in diagnostics.
- **Flexible Application**
  - Treat a wide range of substrates
  - Options include robust long lasting treatments & easy to apply single use options



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ANTI-FOG

For applications requiring optical clarity in wet or humid environments Aculon's hydrophilic surface treatments are a perfect fit!

- **Hydrophobicity is NOT the answer**
  - Common misconception that a hydrophobic treatment is needed to repel water from glass or camera domes/lenses
    - Hydrophobic treatments cause beading, which result in optical aberrations
  - Hydrophilic is the better fit!
    - Hydrophilic treatment results in a water wetting surface minimizing optical impacts
- **Aculon can apply a robust hydrophilic solution to a variety of optical substrates**

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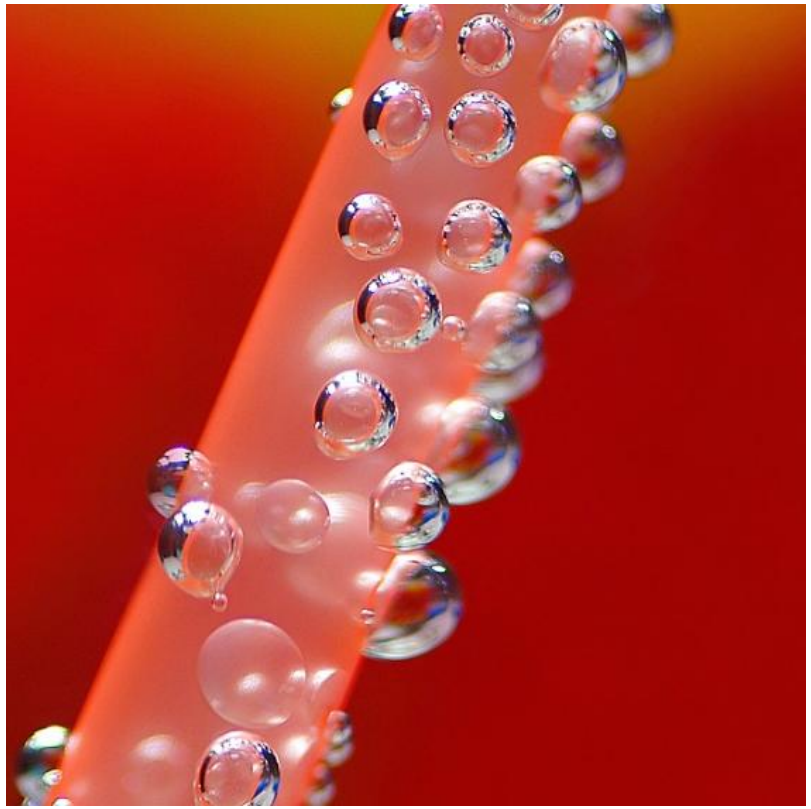
BUBBLE REPELLENCY

Aculon's hydrophilic surface treatments can functionalize your surface to prevent air bubble formation underwater.

- **Anti Bubble Formation**
  - Aculon's hydrophilic treatments can functionalize numerous surfaces to prevent air bubble formation in an underwater environment.
- **Flexible Application**
  - Treat a wide range of substrates
  - Options include robust long lasting treatments & easy to apply single use options



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LAB SERVICES

Understand Customer Requirements → Aculon Lab Services → Analyze & Characterize → Customer Testing & Feedback → Optimize → Selection & Recommendation → Customer Plant Trial

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INTELLECTUAL PROPERTY & EXPERTISE

Strong combination of hard and soft IP:

- Granted over 35 Patents
- Developed many trade secrets
- Treated and tested thousands of applications
- UCSD Partnership gives access to millions of dollars of equipment
- Spent hundreds of thousands of hours solving surface problems
- Invested millions of dollars in building capabilities & expertise

SUSTAINABILITY

Aculon is committed to offering a range of environmentally friendly products and follow good sustainable business practices. We help our customers support their sustainability goals and help protect the environment.

VOC-Exempt Options

PFOA-Free Products

Eco-Packaging & Waste Reduction

- Nearly all Aculon packaging (shippers, pails, bottles) is reusable or recyclable
- Green alternatives are utilized wherever possible
- From paper to pens, reusable or recyclable office supplies are used throughout our business operations

Reduced Transportation-Related Emissions

- Reduced material used → reduced transportation of material & wastes
- Localization with suppliers & distributors in Europe & Asia
- Utilize carbon-neutral shipping options when using UPS

Sustainable Energy & Increased Efficiency

- Retrofitted LED Lighting Throughout our HQ (>800 LEDs) & Utilize Extensive Natural Light
- Switched to Energy Efficient Equipment

CONCLUSION

- Platform technology company that make customers products better!
- Surface solution experts
- Strong history of working with customers to solve problems
- Broad portfolio of products, including more sustainable options
- Strong IP, testing capabilities and in-house expertise

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