Sapphire Repellency Treatment Technology
Agenda

Aculon Overview
Aculon Technology Overview
Sapphire Repellency - Overview
Sapphire Repellency - Performance
Sapphire Repellency - Applications
Summary
Overview

Aculon is a leading provider of surface modification technologies.

- Surface Solution Experts who supply treatments to large markets including oil & gas, consumer products & electronics – over 25 commercial programs
- Strong IP – 28 granted patents and 15 in process
- Provide repellency technology that modifying surfaces in seconds with little or no capital.
- Sapphire Repellency Treatments – Utilized in dozens of applications for over 5 years
About Aculon

- Specializes in developing and supplying easy to apply surface modification treatments
- Treatments Include: Hydrophobic, Hydrophillic, Oleophobic
- Located in San Diego, CA
- www.aculon.com
Expertise & Platforms

- Specialty
  - Sapphire
  - Optical

- Surface Modification
  - Medical Diagnostics

- Oil & Gas
  - Anti Fouling
  - Proppant
  - Rock Formation

- Electronics
  - PCB protection

- Electronics
  - Stencils

NEW
- Medical Diagnostics
Agenda

Aculon Overview

Aculon Nanotechnology

Sapphire Repellency - Overview

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Sapphire Repellency - Applications

Summary
Why do you need repellent sapphire?

In real life, sapphire is exposed to water, oils, and other fouling agents which can inhibit its performance

- Fouled sapphire sensors can yield poor data
- Fouled sapphire can prevent viewing of pipeline or tank materials in oil/gas and industrial applications.
- Removing sapphire parts for cleaning often impossible or cost & labor prohibitive!
Numerous applications……

Aculon Sapphire Repellency Treatment qualified in variety of applications

- Optical Flow Sensors
- Oil Pipeline Viewports
- Downhole drilling optical sensors
- Sapphires utilized in analytical equipment
- Many others in test……
Benefits include:

- Aculon Sapphire Repellency Treatment provides water, solvent, and oil protection.
- 2-4 nm thick, optically clear with 100% transmission
- Reduce cleaning and equipment downtime
- Enable ability to observe highly fouling solutions where viewports would immediately be visually impaired with untreated sapphire
- Extremely easy to apply in manufacturing environment or in field
- Coating is safe, non toxic and can be used in factory environment
Application Process

Aculon will work with you to determine best application process...

- **Wiping:** RECOMMENDED
  - Process duration is typically minutes per part
  - Treat up to 1 square foot per kit
  - $25 per treatment
  - No training or equipment needed.
  - Apply in the factory or in the field

- **Dipping:**
  - Aculon can assist with dipping applications for complicated parts and large process volumes
  - Process duration is typically a matter of minutes
  - Aculon can provide support with implementing treatment into your production process
  - Contact Mario Gattuso ([Gattuso@aculon.com](mailto:Gattuso@aculon.com)) for more information
Aculon Sapphire Repellency Treatment is available off The Shelf

Each kit ($250 USD) includes

- Treatment for 10 sapphire parts of up to 1 square foot each
- Windex cleaning solution (good option)
- Instructions
- Aggressive cleaning solutions also available for critical components – please inquire
Aculon NanoProof™ Series offerings utilize proprietary coating that makes objects hydrophobic

**Sapphire Repellency Features**
- Hydrophobic and oleophobic
- Optically Clear – 100% Transmission
- Application via Easy to Apply Wipe
- No Equipment Required
- Uniform Thickness 2-4 nm

**Sapphire Repellency Performance**
- Hydrophobic +115° water contact angle
- Oleophobic +80° oil contact angle
- Thermally stable to 225°C
- Resistant to Solvents and Acids
- Abrasion Resistant – Durable Covalent Bond
Aculon Sapphire Repellency is highly repellent to oil & water:

**Hydrophobic**

Water Contact Angles

- Sapphire: 65
- Sapphire w/ Aculon: 115

**Oleophobic**

Oil Contact Angles

- Sapphire: 10
- Sapphire w/ Aculon: 83
Aculon Sapphire Repellency Treatment Performance is easy to see!  
Crude oil slides right off treated parts!
Durability

Abrasion
- Covalent bond: 2-4 nm thick
- Durable to most all fluid flows – oil/water mixes, slurries etc
- Damage by abrasion only possible when underlying sapphire substrate damaged

Chemical Compatibility
- Compatible with organic solvents, neutral aqueous solvents & acidic solvents which do not etch untreated sapphire
- Not Compatible with caustic solvents (pH 10+)

UV & Temp
- Stable to 225°C
- Impacted by UV – But can be reapplied in field
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Summary
Analytical Sapphire Optics

- Prevent condensation & moisture build up on sapphire parts
- Prevent nearly all liquids from fouling surface or bonding with surface
- Improve ease of cleaning optics – reduce risk of damaging sensitive components
Oil & Gas Applications

Optical Viewports
• Prevent paraffin fouling
• Compatible with most oil/water material flows
• Fouling agents slide off and allow for viewing without cleaning

Down Hole Sensors/devices
• Eliminate hours of downtime and cost needed to remove sensors for cleaning of sensitive optical

Optical Analytical Sensors
• Accurate measurement results improved by eliminating fouling agents which can interfere with sensors
In summary

- Leading supplier of NanoScale Repellency Technology
- Sapphire Repellency Treatment functionalizes sapphire with no impact on transparency
- Samples available on the website http://www.aculon.com/sapphirewipes.php
- Easy to apply
- No Equipment needed
- Cost reduction from improved process
- Proven to outperform competitive technology
- Aculon supply chemistry globally
Performance • Surface • Solutions

Thank you