Surmet Corporation

Commercialization of Si Cladding Technology that Enables Precision Finishing of SiC Mirrors

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Outline

- About us
- Capabilities
  - Amorphous Si Claddings for SiC Mirrors
- Accomplishments in the Field
- Q&A
**Ultrahigh Purity Amorphous Silicon Cladding** - enable precision finishing of SiC mirrors

**Low temperature Plasma Assisted process:**

- Cladding thickness up to **100 microns**
- Multiple coating chambers in place
- Applied at very low temperatures, **<150°F**
- **Conformal coating**, can coat 3-D non-flat shapes including lenses, and domes
- Current size capability is **40-in diameter** but can be scaled up to even larger sizes
- Cladding applied onto **variety of SiC substrates**
- Cladding finished to tight optical specifications – **0.012 waves TWFE achieved**

*Surnet is reliably supplying such Si-claddings to Space Telescope Systems Integrators*
About us

Globally Recognized Technology Based

US Small Business Enterprise

Founded 35 years ago on a Simple Principle:

*Today’s Materials Aren’t Adequate to Meet The Challenges Of Tomorrow’s Machines, Devices and Systems*

Our Focus: Take Laboratory Inventions to The Production Floor
About us

Recipient of Multiple Prestigious Awards

2013 - ACerS Corporate Technical Achievement Award
Successful scale-up and commercialization of ALON® Transparent Ceramics

2016 - The Defense Manufacturing Technology Achievement Award
For ALON® Transparent Ceramic Scale-up Efforts

2017 - ACerS Medal for Leadership in Advancement of Ceramic Technology
Surmet’s Founder Dr. Suri Sastri was recognized for his vision, leadership and entrepreneurship in successfully developing and commercializing transparent polycrystalline ceramics
About us - Facilities

- **Burlington, MA:**
  - Surmet Headquarters (6,500 sq ft)
  - R&D Facility (7,000 sq ft)
  - Manufacturing Facility (8,000 sq ft)

- **Buffalo, NY (75,000 sq ft)** Powder production and Advanced Ceramics Manufacturing

- **Murrieta, CA (6,250 sq ft)** For Fabrication of Precision Optics Components

ISO-9001 Certified Quality System

ITAR Compliance Implemented

SECRET Level Facility Clearance

Vertically Integrated Optics Manufacturer
### Capabilities

**Advanced Coating Technologies**

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<th>PA-CVD Technologies:</th>
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<td>• Mirror tech - <strong>UHP Amorphous Silicon</strong></td>
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<td>• Wear-resistant hard protective coatings</td>
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<td>• Anti-Reflection Coatings</td>
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<td>• Hard, Scratch-resistant Transparent Coatings</td>
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<th>PVD Technologies:</th>
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<td>Metals, Amorphous Oxides, Nitrides and Oxy-nitrides</td>
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Capabilities
Advanced Coating Technologies

- **UHP Amorphous Silicon**
  - Featureless, Amorphous
  - Strongly Adherent
  - Ultra-homogeneous
  - Applicable onto variety of substrates
  - High Purity
  - Very Low Deposition Temperatures
  - Diamond-turnable and Polishable via Magneto-Rheological Finishing
  - Achieved wave-front error as low as **0.015 \( \lambda \) RMS**

Cross section of Surmet’s 18.6 \( \mu \)m Amorphous Silicon
Capabilities - UHP Amorphous Silicon

Enables Finishing of SiC Mirror Substrates*

- SiC appears to be material of choice for Polishing of SiC optics has been a challenge, primarily due to the material’s slow removal rate.
- Thin Silicon cladding to the SiC optical component solves this issue. The cladding allows for optical finishing, being ductile enough to be diamond turned, and readily post-polished.
- Above Figures shows an interferogram obtained from an off-axis parabolic optical surface (Mirror shown in the above figure as well). This piece has been Si clad, diamond turned, and subsequently post-polished to 0.012 waves.

*Robichaud, et. al; “SiC Optics of SSA and Responsive Space Needs”, 2008
Accomplishments
Surmet Si Cladding Enabled Precision Finishing of SiC Mirrors in LORRI Telescope for NASA’s New Horizon Pluto Mission

Surmet’s coating technology enabled the precise surfaces to be machined onto the imaging surfaces of New Horizon’s Probe that photographed Pluto.
Accomplishments
NASA’s Hubble

- In 2003, Surmet provided the enabling UltraC diamond-like carbon (DLC) coating technology for the Titanium Cryo-cooler component of the Infrared imaging sensors (NICMOS) in the Hubble Telescope.

- The coating made possible near frictionless performance by the Cryo-cooler, at a super high 6000 to 8000 rpm, for years on end helping to bring in astounding images from the edge of the observable Universe.
Vertically Integrated Manufacturer of ALON® and Spinel Vis-MWIR Precision Optics

31” x 35” window
How can we help?