Everything You Ever Wanted to Know About Optical Coatings, but Were Afraid to Ask.

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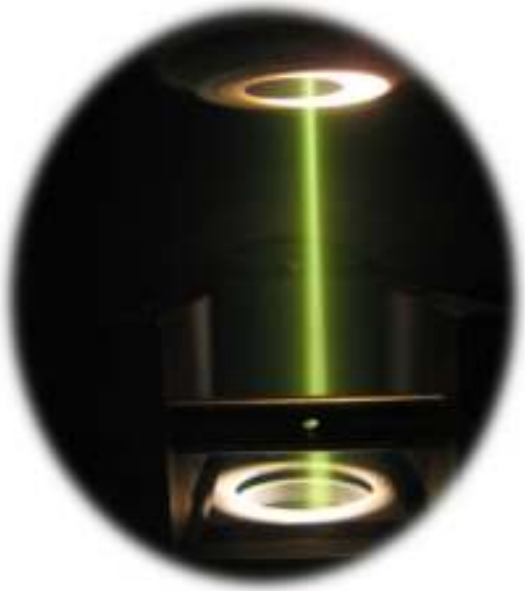
How do stains effect coating performance?

- Reflectance and Transmission Variance
- Refractive Indices effect
- Adhesion
- Weatherability

How do vacuum coatings adhere to a lens?

With Regards to Surface Preparation

- **Surface Preparation**
  - Ultrasonic cleaning
  - Plasma
  - Corona
  - Anti-static air guns
  - Ion assist
  - Degassing oven
- **Bonding of Vaporized Molecules**
  - Multiple Evaporation Methods



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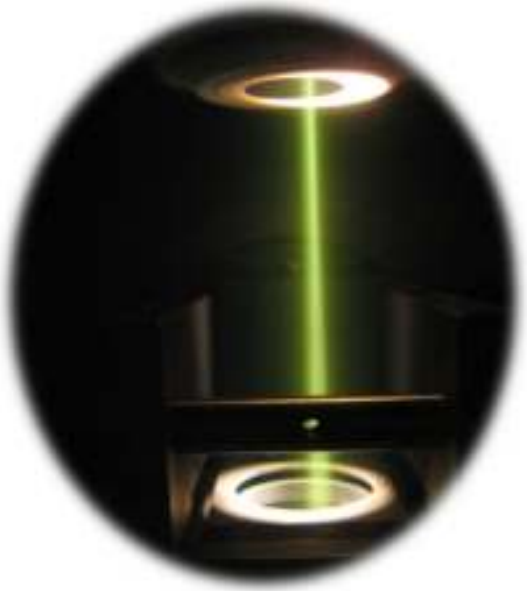
How do vacuum coatings adhere to a lens?

With Regards to Process Parameters

- **Custom Coating Parameters**
  - Special chamber heat controls
  - Thin “seed” layers to promote adhesion
  - Unique gases introduced into the process
  - Vacuum Range specific to formula & material
  - Deposition Rate specific to formula & material
- **Different Materials/Different Expertise**
  - Polymer Optics vs Glass Optics



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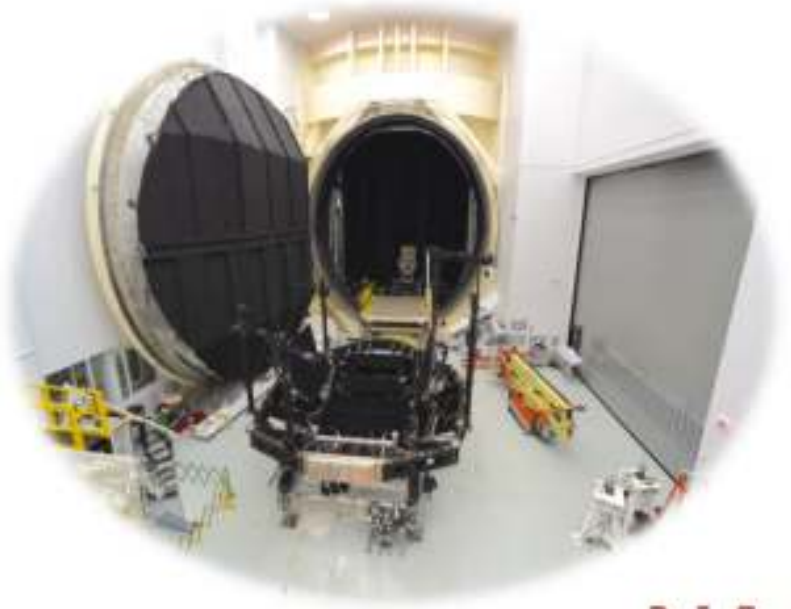
What are the best ways to improve yield on large chamber depositions?

- **Tooling**
- **Uniformity Improvement/Optimization**
- **Rotational/Flip Fixturing**
- **Vacuum Pump Upgrades**
- **Heat Efficiency Upgrades**



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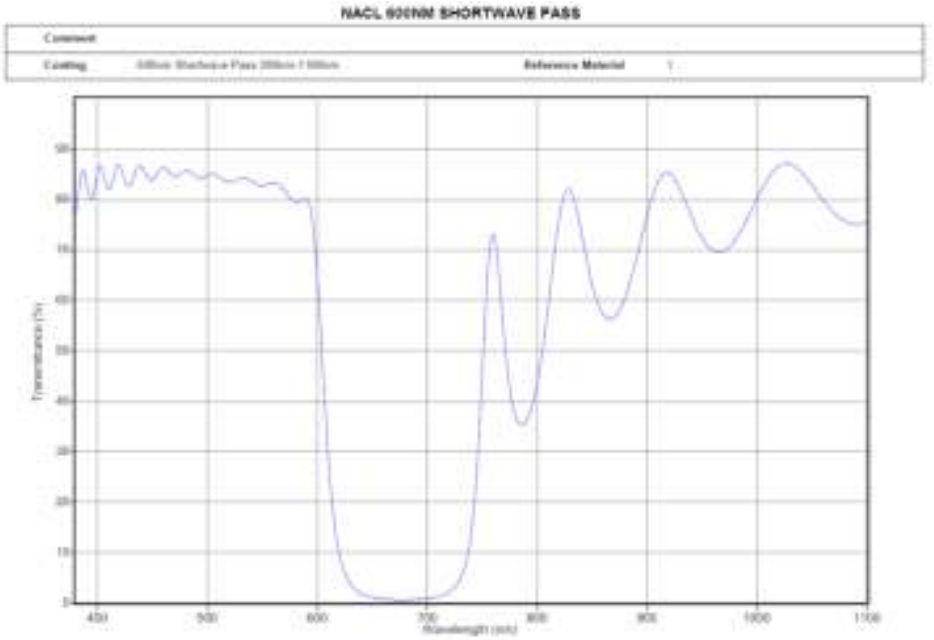
What are some of the constraints and tradeoffs with optical coating design and fabrication when assessing cost/performance?

- Deposition time
- Complexity of the specification
- Repeatability
- Thickness



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How do you quantify the thickness and uniformity of a coating?

- **Quartz Crystal Monitoring**
- **Optical Monitoring**
- **Surface Profile Measurements**
- **Chamber Uniformity Studies**

Which kind of coatings are easy/cheap to manufacture and what makes coatings expensive?

- Deposition Time
- Part Size versus Chamber Size
- Specification Tolerance
  - Absolute vs Average
  - Angle of Incidence
  - S&P
- Thickness or Number of Layers

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What is the best method for pre-cleaning optics before coating?

- Ultrasonic Cleaning
- De-gassing Chamber
- Ion Preclean
- Corona/Plasma discharge

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What are the critical specifications and tolerances for the various coating types?

- Reflectance
- Transmission
- Operating Wavelength
- Angle of Incidence
- S&P Polarization
- Sheet Resistance
- Mechanical Requirements
- Environmental Requirements

How do you make a coating "sunlight" readable?

- Anti-Reflective
- Anti-Glare/Diffuse
- Constructive/Destructive Interference

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What are best practices for making coatings more resistant to weathering requirements?

- Pre-Cleaning
- Quality Vacuum During Coating
- Consistent Heating
- Suitable Tooling
- Sealing or Protective Layers
- Appropriate Packaging/Storage

Thank You!

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