

LPCVD Technology

A method for coating optical components
of complex geometry

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Deposition Sciences, Inc.
Quality Coating Solutions

Overview

- Common complex geometries
- LPCVD as a coating solution

Complex Geometry



- **What is complex geometry?**
 - An extremely non-planar shape
 - **Why use optics with complex geometry?**
 - Highly optimized for a specific optical application
 - **Examples**
 - Multi-faceted surfaces
 - Parabolic reflectors
 - Small tubes
 - Toroidal lenses
 - **Spheres**
 - **Rods**
 - **Domes**
- } We'll examine these common complex shapes in more detail...

Spheres



- **Common Uses**

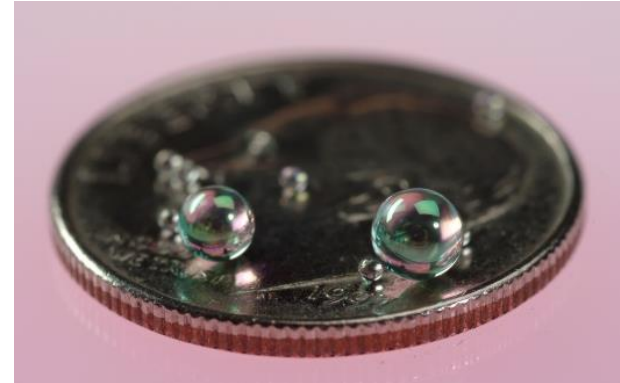
- Ball lenses
- Opto-couplers
- Medical imaging
- Solar concentrators

- **Physical Characteristics**

- VIS, NIR, SWIR material
- Typically $\text{Ø}100\ \mu\text{m}$ – $\text{Ø}10\ \text{mm}$

- **Coating Challenges**

- Chamber mounting
- Conformal coating



Rods

- **Common Uses**

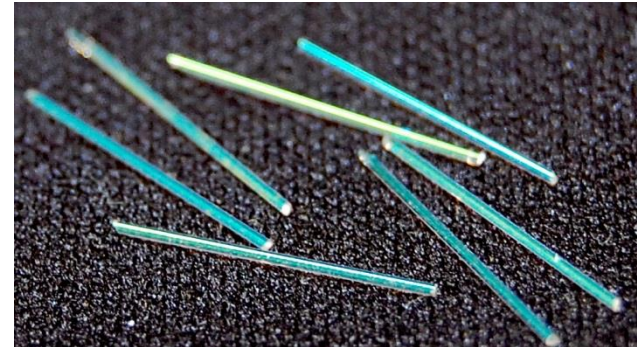
- Asymmetric beam correction
- Laser collimation
- Light curtains
- LiDAR
- Laser pump systems

- **Physical Characteristics**

- NIR, SWIR material
- Typically $\text{Ø}80 \mu\text{m}$ – $\text{Ø}500 \mu\text{m}$

- **Coating Challenges**

- Conformal coating



Domes

- **Common Uses**

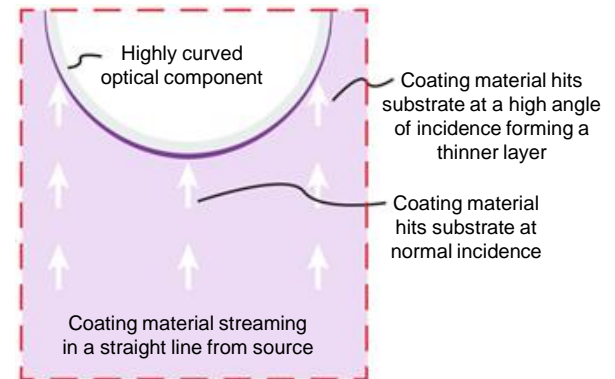
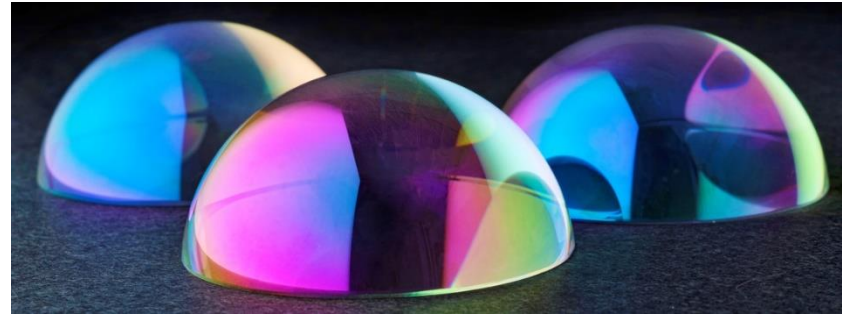
- Missiles
- Cameras
- Surveillance

- **Physical Characteristics**

- VIS, NIR, SWIR+ material
- Typically hemispherical, ellipsoidal or ogival
- Optical window + structural/aerodynamic

- **Coating Challenges**

- Uniformity
- Durability

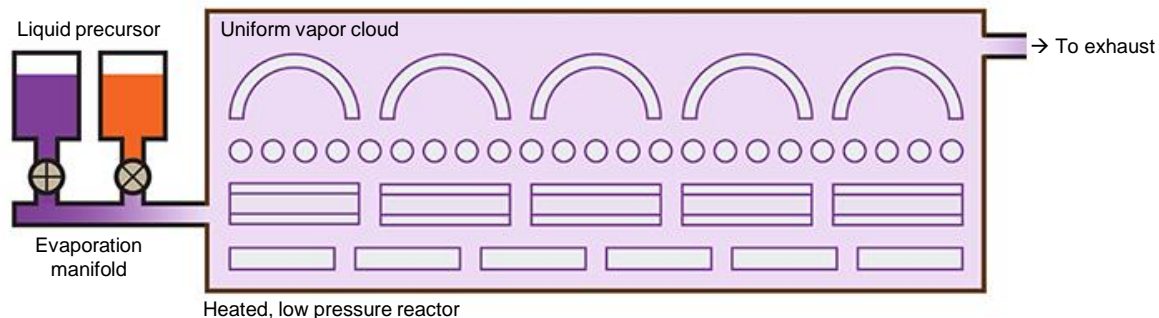


LPCVD Coating Technology



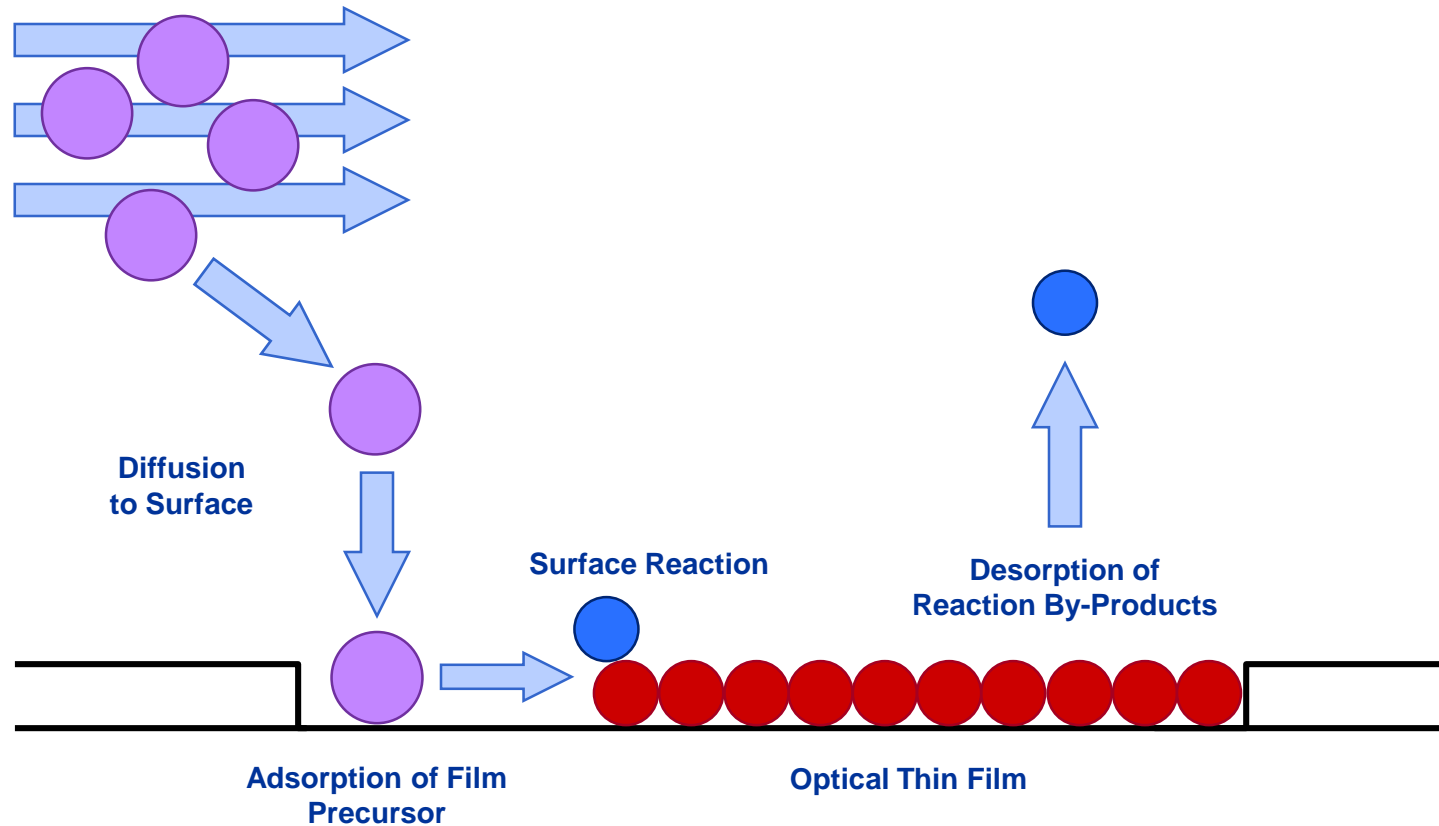
- **Low-Pressure Chemical Vapor Deposition**

- A very different deposition technology
- Common in the semiconductor and lighting industries
- Well documented
- Not line of sight: relies on diffusion of chemically active species
- Low-Pressure: 1 – 10 Torr
- Chemical Vapor: optics are immersed in heated vapor cloud



Deposition Schematic (LPCVD)

Main Vapor Flow



Addressing the Challenges



- **LPCVD addresses the coating challenges of complex optical geometries**
 - Deposition is isotropic
 - Coating is conformal to the substrate shape
 - All exposed surfaces are coated
 - Simple tooling
 - No moving parts are needed
 - No flipping or angular considerations are necessary
 - Thin-films are chemically bonded to the surface
 - Extremely durable
 - Extremely dense

Summary

- **Common complex geometries**
 - Spheres
 - Rods
 - Domes

- **LPCVD as a coating solution**
 - Surface-driven reactions
 - Conformal coating
 - Dense, durable films

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Thank you



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