



COMMERCIAL PRODUCTS GROUP

Into the Future

DSI was established in 1985 with a contract to develop an energy-efficient coating for halogen light bulbs. Since then, we have expanded our role in this specialized market by improving energy efficiency and cost-effective lighting solutions.

With ever-increasing energy costs and the environmental impact of energy production, DSI continues toward the future by partnering with leading companies in the fields of solar power production, solid state lighting, and energy-efficient conventional lighting.

Our innovations expand beyond energy. From special reflectors which improve the image quality in vision systems, and spectral metal coatings that enhance performance and decrease manufacturing costs in curing systems, to improved fluorescence filters to aid in the life sciences, DSI continues on the forefront of advanced coating technology.

DSI Deposition Sciences INCORPORATED

COMMERCIAL PRODUCTS GROUP

World Leader in
High Performance,
Ultra-Durable
Thin Film Coatings

Bringing Technology to Light



CHECK-IN

Breakthrough technologies, breakthrough optical coatings

Since 1985, Deposition Sciences, Inc. (DSI) has specialized in bringing new optical coating technologies to market with the design, development, and incorporation of proprietary deposition processes. The result is the creation of several unique thin film coatings, often combined to enable our customers to create new products, improve performance, and compete with more cost-effective solutions.

As a global leader in the development, deposition and delivery of precision, durable optical thin films, DSI provides coatings for a host of commercial and industrial applications including:

- Automotive
- Aviation / Aerospace
- Biological Sensors
- Biomedical
- Digital Cinema
- Fiber Optics
- High Speed Integrated Circuits
- High Resolution Camera Systems
- Homeland Security
- Lighting
- Medical
- Mobile Telecommunications
- R&D
- Scientific
- Sensors
- Solar
- Solid State Lighting



Coating Products:

Anti-Reflection Coatings

Ball Lenses

Beamsplitters

CCD Filters

Dark Mirrors

Dichroic Patterned Filters

Dielectric Filters

Edge Filters

Heat Resistant Coatings

Infrared Filters

Neutral Density Filters

Notch Filters

■ **Capabilities overview**

DSI produces a wide variety of highly reliable, durable, and heat-resistant optical coatings. Our exclusive technologies and custom deposition chambers offer coatings in the ultraviolet (UV), visible (VIS), near-infrared (NIR), shortwave infrared (SWIR), midwave infrared (MWIR), far infrared (FIR), and longwave infrared (LWIR) spectral wavelengths.

In addition to offering standard products, we work in close collaboration with our customers to develop innovative coatings that fit specific requirements. Known for our strong engineering services, we will help define your needs and provide creative solutions for real-world applications.

We work closely with our customers from concept through completion, maintaining long term relationships and product partnerships.

■ **DSI facilities**

Our modern 144,000 sq. ft. facility is located in Santa Rosa, California. It includes a class 100,000 factory, manufacturing in class 100 and class 1000 clean room environments, and a powerfully advanced and stringent quality assurance lab.

With lean manufacturing standards, exceptional engineers, and a dedicated staff, we meet the diverse needs of customers who require research and development, high volume manufacturing, and cost-effective thin film coating solutions for all types of environments.

Optical Mirrors

Optics for Night Vision

Patterned Thin Film Filters

Rugate Filters

Solar Cell Coverglass

Spectral Metal

Sunshade Solar Rejectors

Telescope Optics

UV Filters

Visible Filters



www.depisci.com



Specialized coating processes – uniquely ours

Our long-standing success is based on a commitment to the continuing development of new coatings, processes, and technologies to produce improved products that fit the needs of a broad range of current and future applications.

DSI has implemented four separate systems to accommodate the varied and often rigorous demands placed on thin film coatings. This complete toolbox gives us the ability to provide unique solutions, higher performance, increased volume, and more durability in our coatings.

MicroDyn® Reactive Sputtering

The MicroDyn process is a short-throw reactive sputtering process that is proprietary to DSI and is the subject of a number of patents. The process is highly flexible, with the capability to deposit metals, metal oxides, nitrides, mixed materials with fixed or graded compositions, rugates, ITO, and semiconductor materials. Selected coatings are capable of operating at temperatures as high as 1000°C and can withstand the thermal shock of direct transition from liquid nitrogen to boiling water.

MicroDyn coatings have minimal wet-to-dry spectral shifts. The process is able to produce highly precise filters, including narrow bandpass filters. The MicroDyn process can be operated at temperatures as low as 70°C, and is capable of deposition on engineering plastics and fiber optic cables. Coatings can even be applied to highly convex and concave surfaces such as lamp envelopes and reflectors – with no loss of durability or performance. MicroDyn coatings, including complex filters, can be patterned using both contact masking and photolithography techniques.



IsoDyn™ Low Pressure Chemical Vapor Deposition (LPCVD)

The LPCVD process is a thermally driven organo-metallic process that is currently configured to deposit multi-layers of silicon dioxide, tantalum oxide, and titanium dioxide as needed. The LPCVD process is useful for coating almost all optical glasses, crystalline materials, ceramics, and metals. The unique aspect of the LPCVD process is its capability to uniformly coat all surfaces of even the most complex shapes with a high quality multi-layer optical coating. Like the MicroDyn process, the IsoDyn LPCVD process provides coatings with service temperatures as high as 800°C, with high resistance to thermal shock.



The LPCVD process is fully automated and is capable of manufacturing complex filters.

IsoDyn™ Plasma Enhanced Chemical Vapor Deposition (PECVD)

DSI's PECVD process uses a high intensity microwave source to drive the plasma that provides the energy for deposition. The PECVD process is capable of depositing metal oxides, nitrides, and semiconductor materials. The unique aspect of the PECVD process is that it allows deposition on the inside (or outside) surface of a tube or cylinder. As with the MicroDyn and LPCVD processes, the coatings produced are capable of operating at temperatures as high as 800°C and withstanding severe thermal shock.

Evaporative Coating

DSI's evaporative coating chambers are used for complex infrared coatings. Advanced thin film designs are deposited in precision, cryo-pumped vacuum chambers using electron beam guns and resistance sources with the option of ion assist. Coatings are stable, can be laser and nuclear hardened, have minimum scatter and absorption, are space-qualified and meet all applicable military specifications.

Evaporation is especially efficient for depositing complex multilayer interference coatings on flat and slightly curved substrates. Infrared coatings with spectral performance requirements out to 25 μm in wavelength can be produced. Typical applications are longwave passes, shortwave passes, narrow bandpasses, beamsplitters, and anti-reflection coatings. Metals, metal oxides, dielectrics and semiconductors are deposited on various substrates, some of which include glass, silicon, germanium, zinc sulfide, and zinc selenide.



Why extreme durability?

Many coated products face exposure to extreme conditions such as high heat, temperature fluctuations, severe abrasion, saltfog, high humidity, harsh chemicals, and sub-freezing temperatures, with little or no protection.

DSI took on the challenge of developing a highly advanced system to meet these harsh environments with reliable, highly durable thin films. Over a period of years our R&D and scientific engineering teams designed proprietary systems that produce precision optical coatings with high durability in high volume.

Our first endeavor was to create optical films that could withstand the extreme heat and long service life in lamps such as quartz halogen and metal halide arc systems. These applications require that optical films operate for thousands of hours at temperatures ranging from 800°C to 1000°C. In addition to extremely high heats, the films must survive repeated thermal cycling, from ambient temperatures to operating temperatures, with a cycle time of only a few seconds. This quick heating-cooling action can destroy the integrity of an optical coating. Thus, the IsoDyn LPCVD system was born.

We didn't stop there.

Three years later, we did it again. After a successful launch of the IsoDyn process, we went back to work – this time to develop a system that would produce the same durability as IsoDyn, but with the added benefit of even faster production. The effort culminated in our patented MicroDyn system. And now DSI has a coating process for virtually every type of optical component, no matter how complex.



Applications:

Aerospace & Defense Products

Biofluorescence

Digital Imaging

Fiber Illuminators

Industrial IR & UV Curing Filters

Information Displays

Large Optics

LED Marine Signaling

Applications and improved product performance

■ *Commercial Products*

DSI serves many markets and industries with our coated optics, spectral metals, and dichroic filters. DSI supplies coatings for front projection display, rear projection display, LCD display, and digital cinema arenas with our Super HeatBuster® Hot Mirror, Cold Mirror, and UV Blocking filters where coatings are required to withstand high thermal loads (high temperature) and high UV flux.

We supply heat suppression, light color control, and color correcting coatings on reflectors or flat filters to the medical industry, for both surgical lighting and analytical instrumentation.

DSI is also a preferred vendor for color filters in airport lighting because of the advanced stability of our durable coatings which do not shift with changes in humidity or temperature. Our products are able to withstand the harsh environment of an airport with exposure to jet fuel, jet exhaust, and de-icing fluids. DSI's coatings withstand all of these environmental challenges and much more.



Life Sciences

Light Tunnels

Museum Lighting

Ophthalmic Lens Coatings

Projection & Digital Display Systems

Reflectors

Retail Display

Solar Simulation & Material Aging

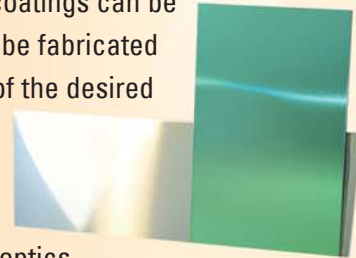
Space & Satellite Apparatus

X-Ray Systems

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Spectral Metal Thin Film Coatings

Our HeatBuster Spectral Metal product line is a breakthrough dichroic hybrid coating, designed to be highly reflective over selected bands of wavelengths and minimally reflective over the rest of the spectrum. It combines the spectral advantages of glass mirrors with the cost-savings and durability of sheet metal fabrication and is able to operate over a wide range of angles. The base material is highly polished stainless steel. A "dark mirror" coating is initially deposited onto the substrate which optically couples the unwanted wavelengths into the metal. A highly-reflective dichroic coating is then applied onto the "dark mirror". The finished product is a spectrally-selective mirror that is highly durable, reliable and reflective. Spectral Metal coatings can be fabricated into many forms. Curved collection optics can be fabricated as long "trough" reflectors, then laser-cut into segments of the desired length. Alternatively, the HeatBuster Spectral Metal sheets can be laser cut into simple or complex shapes after the coating process. Fabrication of the sheets after coating eliminates the need for expensive tooling for the optics or the coating chamber.



Patterned Dichroic Filters

Patterned Dichroic Filters are produced using the latest photolithography equipment and DSI's advanced coating techniques. This enables us to apply multiple coatings on a single substrate with dimensions as small as 100 μm , with accuracy of $\pm 1 \mu\text{m}$ and feature placement accuracy of $\pm 5 \mu\text{m}$. These filters can operate over a wide range of wavelengths and offer superior performance from the near ultraviolet to the infrared. They can be applied to a variety of substrates in many shapes and sizes, as well as wafer substrates up to 100 mm diameter on materials such as silicon, glass, sapphire and fused silica. Patterned Filter coatings are ideal for use in CCD imaging applications where a single optic is required to perform multiple functions.

A collection of optical fiber components including a white plastic connector, a metal ferrule, and several small glass lenses or couplers, some with red and blue markings.

■ **Telecom Products**

DSI is a major supplier to the telecommunications industry. We offer a full line of micro-optics for passive components.

IsoSphere™ AR Coated Ball Lenses

The IsoSphere AR coated ball lens represents a breakthrough in the technology of ball lenses. Previous coating methods yielded soft, non-uniform single layer AR coatings on ball lenses. DSI's exclusive IsoDyn low pressure chemical vapor deposition (LPCVD) process provides a uniform, highly durable high performance AR coating over the entire surface of the lens. DSI's IsoSphere ball lenses are an inexpensive, mechanically compact optical method for collimating the output of an optical fiber or laser diode. They can also be used for fiber to fiber, diode to fiber, and fiber to detector coupling when access to the beam is required. Ball lenses are a mechanically simple and economically attractive optical solution to a number of fiber optic coupling and collimating challenges.

■ **Military and Aerospace Products**

With our in-depth background and expertise in ruggedized thin films, DSI has provided optical coatings for military, aerospace and space based programs for decades. These include longwave pass, shortwave pass, and band pass filters on exotic materials such as Silicon (Si), Germanium (Ge), Zinc Sulfide (ZnS), Zinc Selenide (ZnSe) and ClearTran as well as optical glasses for systems which operate across the visible, near infrared, shortwave infrared, midwave infrared and far infrared ranges out to 50 μm . For more information on our military and aerospace division, please request DSI's Special Products Group brochure.

Services

DSI has the expertise to participate at any level of your product development. From engineering to prototyping to full-scale manufacturing, we will work with you to develop practical specifications, designs, and manufacturing techniques to meet your requirements.

Test and Measurement

Quality testing capabilities include measurement of in-house produced materials as well as the independent verification of external coated and uncoated samples for vendor/supplier surveillance, process analysis, and qualification testing. Our quality system is being upgraded with ISO 9001:2000 certification pending. Below is a summary of some of our test and measurement capabilities.

Spectral Measurement Capabilities:

- Spectral Range 0.190-50 μm
- Reflectance and Transmittance (near normal to 45 degrees)
- Cryogenic Measurements (ambient to < 10 kelvin)
- Polarized Measurements (S&P)
- Hemispherical Transmittance and Reflectance (0.2 - 2.5 μm)

Environmental Testing:

Environmental Testing can be performed in accordance with various military specifications, including MIL-C-48497 and MIL-F-48616.

- Humidity
- Saltfog
- Abrasion
- Temperature Cycle
- Adhesion
- Solubility
- Cleanability

Substrate Materials:

<i>Aluminum Oxide</i>	<i>Kapton®</i>	<i>Quartz</i>	<i>Tape</i>
<i>Ceramics</i>	<i>Most metals</i>	<i>Sapphire</i>	<i>Zinc Selenide</i>
<i>Germanium</i>	<i>Polyester</i>	<i>Silicon</i>	<i>Zinc Sulfide</i>
<i>Glass</i>			

Physical:

- Flatness/Reflected Wavefront Error (capable of ± 0.05 waves, peak to valley @ 632.8 nm on up to 4" diameter samples)
- Surface Quality Characterization (scratch/dig, scatter, BRDF)
- Surface Resistivity (0 - 50k ohm/sq)
- Dimensional verification ($\pm 0.5 \mu\text{m}$)

Infrastructure Support

DSI has in place the infrastructure to support government and aerospace contracts. We have the experience and expertise to manage subcontracts and efficiently navigate government reporting requirements.

Support Includes:

- DoD Accredited Facility
- DCAA Approved Accounting System
- Familiarity with Government Required Program Management Activities (e.g. SDRL reporting)
- ITAR Compliant
- GFE/GFM Traceability System

Other Services

- Coating Design
- Prototyping
- Pilot Production
- Volume Production
- Concurrent Engineering
- Materials Research
- Photolithography
- Filter Dicing
- Color Modeling and Measurement
- Manufacturing in Class 100 and Class 1000 Clean Areas

Substrate Types:

Complex Shapes

Flexible Substrates

Fiber Optics

Rods and Tubes

Flats and Lenses