Inradoptics
A Luxium Solutions Company

Metal Optics

Overview

Inrad Optics' metal optics division fabricates a diverse array of mirrors from aluminum, beryllium, AlBeMet, stainless steel and more exotic alloys. In particular, we specialize in high precision scan mirrors, on- and off-axis parabolic mirrors, and lightweight optical assemblies.

Scan mirrors are available in elliptical, oval or free-form outline shapes in excess of 500mm can be machined with integrated mounting features like journals, bearings, and tabs.

For ultra-lightweight high-stability mirrors, beryllium and AlBeMet are ideal materials. Beryllium offers high thermal conductivity, corrosion resistance, a low CTE, and the highest strength and stiffness-to-weight ratios of nearly any metal alloy available. These properties make it uniquely qualified for fast steering mirrors, ground vehicle head mirrors, space telescope mirrors, and airborne EO/IR platforms.

Capabilities	Advantages
Precision machining of AlBeMet and beryllium	Ultra-lightweight, high stability mirrors
In-house nickel and gold plating lab	Fast processing and excellent CTE match
Advanced Metrology: 18" Zygo, CGHs	Ideal setup for fabricating and testing large precision optics
Precitech capable of cutting up to 1 meter optics	

Diamond Turning & Polishing

Inrad Optics has both diamond flycutting and turning capabilities, with flycut lengths up to 26" and diamond turned off-axis elements within a 1 meter swing. Ultimately, figure accuracy depends on a number of factors beyond machine capability, including component geometry, tooling design, cutting tool specifications and substrate material. Our proprietary cutting tool design and tool inspection techniques optimize finishes while minimizing tool-induced stresses and sub-surface damage.

With diamond machining alone, $\lambda/4$ PV surface figure is typically achievable on plano, spherical, and aspherical surfaces. Inrad Optics also employs continuous polishing, spindle polishing, and CNC polishing for superior surface quality. Nickel plated, diamond machined surfaces can be post-polished to $< \lambda/10$ PV and < 20 Å RMS for low scatter optics. Mechanical tolerances between cut surfaces and multiple datums are held to approximately 30 millionths of an inch.

Thermal Processing

Inrad Optics maintains thermal cycling chambers and other equipment capable of thermal excursions from 1450F to cryogenic temperatures and in inert atmospheres. Repetitive cycles can be programmed with tightly controlled ramp rates and dwell times for optimum stress relief throughout the fabrication process. Interferometric measurements can be on flat optics during temperature testing.

Plating & Chemical Processing

Our in-house wet process capabilities reduce risk and cycle times compared to out-sourced services. We offer electroless nickel and electrolytic gold plating as well as specialty chemical processing as part of our vertically-integrated manufacturing operation.

Plating

Our plating lab controls the phosphor concentration carefully during nickel plating to optimize CTE match with the base metal and can provide differential thickness and surface selective plating to optimize component stability and support a wide range of thermal operating environments. Overall, electroless nickel plating presents a cost-effective alternative to bare aluminum optics, particularly when coupled with an electrolytic gold optical overcoat. Electrolytic gold surfaces display excellent environmental durability and high reflectivity across a broad spectrum. For a comparison of the spectral performance of electrolytic gold plating versus evaporative gold coating from UV to MWIR, visit www.inradoptics.com/capabilities.

Specialty chemical processes

We offer electro-chemical etching of alphanumeric text and symbols for serialization and part labelling as well as MIL spec legend inks, dyes, and paints. Available surface treatments include MIL spec polymer-based primers and topcoats, chromic conversion, and passivation.

Thin Film Optical Coatings

We operate our thin film coating systems in a dedicated clean room area to ensure quality. All our coatings conform to strict military and industrial specifications. Our coating chambers all feature state-of-the art computer controlled coating processes, optical monitors and crystal oscillators for deposition rate control. Our in-house coating lab offers enhanced and protected gold, silver, and aluminum coatings and uses thermal, Ion-assist and Plasma-assist E-beam vacuum deposition techniques. Coating durability inspection capabilities include salt-fog, adhesion, abrasion, and humidity testing.

Metrology

Inrad Optics has extensive testing capabilities for optical, structural, and thermal requirements. Due to the complexity of surface shapes fabricated in our metal optics division, optical testing routinely employs high quality computer generated holograms (CGH), null tests, and hindle sphere arrangements. Inrad Optics utilizes Wyko profilometers for surface finish, Zygo interferometers ranging from 4” to 18” for surface accuracy measurements, and Zeiss CMM for verifying geometric dimensions and tolerances. QC personnel use white light inspection booths, video microscopes to evaluate surface quality, and spectrometers for spectral reflectivity measurements.

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