

Electroplating Requirements for Optical Module Shells



Overview

Optimizing the electroforming process for full-shell X-ray optics Optimization of the electroforming process, in some cases, improved the optical performanc.

Key Takeaways

High-precision optical module shells require controlled nickel or nickel-cobalt electroplating with strict attention to thickness, stress, and surface quality to ensure optical performance and mechanical stability. Material Selection

Optical module shells are typically electroplated using nickel (Ni) or nickel-cobalt (NiCo) alloys. NiCo alloys, often in an 85:15 Ni to Co ratio, are preferred for their high tensile strength and Young's modulus, which help maintain shell shape and reduce deformation during handling or assembly . The inner surface of the shell replicates the polished mandrel, so the plating must faithfully reproduce the mandrel's surface roughness and figure .

Substrate Preparation

- Mandrel or shell substrate must be super-polished and free of defects, as surface roughness directly affects the final optical quality .
- Passivation layers (e.g., oxide coatings) are applied to reduce adhesion of the plated material, facilitating separation without damaging the shell .

- Smooth and defect-free surfaces are critical; poorly machined or porous substrates can lead to uneven plating or trapped fluids, compromising optical performance .

Electroplating Process

- Electroforming is commonly used for full-shell optics, where the mandrel acts as the cathode and Ni or NiCo is deposited from sulfamate electrolytes .

- Electric field uniformity is crucial; non-uniform fields can cause thickness variations exceeding 20%, which can be reduced to under 5% using shields and insulating gaskets .

- Deposition stress control is essential to prevent figure errors. Positive stress indicates tensile stress, negative stress indicates compressive stress, and optimal stress levels are maintained through electrolyte composition and current density .

Thickness and Class Requirements

- Electroless nickel plating: Typical thickness ranges from 0.0010-0.0017 inches, depending on class and application, with phosphorus content adjusted for solderability (1-3%) or corrosion resistance (9-13%) as needed .
- Electrodeposited nickel plating: Default thickness for wear or corrosion protection is 0.0020-0.0030 inches, with critical locations specified on engineering drawings .
- Thickness uniformity is critical for alignment and mounting in optical modules .

Post-Plating Treatments

- Thermal treatments may be applied to improve adhesion or hardness:
 - 250-450°F depending on substrate and plating class .
- Hydrogen embrittlement relief may be required for high-strength ferrous alloys, typically involving a bake at 375°F for 2-3 hours .

Quality Considerations

- Surface replication fidelity: The plated shell must accurately replicate the mandrel's surface profile.
- Stress and figure control: Finite element modeling can predict electroforming stress effects, particularly at shell ends .
- Reusability of mandrels: A single mandrel can produce multiple shells without significant degradation, making the process cost-effective .

Summary

For optical module shells, precision electroplating requires careful control of alloy composition, substrate preparation, plating thickness, stress, and post-treatment. NiCo electroforming or electroless nickel plating are standard approaches, with uniform deposition and minimal stress being critical to achieving high-resolution, lightweight, and mechanically stable shells suitable for optical applications .

Article Content

Optimizing the electroforming process for full-shell X-ray optics

Optimization of the electroforming process, in some cases, improved the optical performance of the shells. Using finite

OSFP MSA Rev 5

Rev 4.0 May 28, 2021 Figure 12-8, OSFP-RHS module upper shell tolerance is tightened from 8.2+0/-1.0mm to 8.2+0.1/-0.3mm.

CN120350415A

The invention belongs to the technical field of optical module manufacturing, and particularly relates to a high-temperature-resistant

Why Plating Adhesion Matters in Optical Module Housings When

Plating adhesion refers to the bonding strength between the plated layer and the base material. A coating may appear smooth and

Co-Packaged Optic Assembly Guidance Document

In such cases, each optical module will require a minimum of one fiber per wavelength connected to the ELS module. The number of

Optical Module Production Technical Requirements

This article focuses on the key points of optical module processing and manufacturing process control, and how to

Key Technology of Optical Module PCB

The gold finger part of the PCB of the optical module is an important interface area connecting the optical module with

Optical Module PCB | APTPCB

A comprehensive guide to Optical Module PCB design and manufacturing. Learn definitions, key metrics, selection trade-offs, and

Designing a Module for High-Speed Optical Communication

The ultimate goal for all-optical connectivity with an ultra-high F5G bandwidth is to increase transmission rates. Optical modules —

Harsh Environment Connector Material Selection Guide

To properly function in so many different environments, manufacturers use all sorts of metals, plastics, rubbers, and ceramics

Mil-Spec Connector Materials & Finishes

This coating is the connector's supplemental defense against corrosion and can be made conductive to provide shell-to-shell

Optical Module Housings Guide

An optical module housing is the protective outer shell that encloses the internal components of an optical transceiver

Optical Electroless Nickel | Metal Plating & Coating | Techmetals

With over 50 years experience in the metal plating industry, Techmetals offer similar coatings for optical use, such as OptaKoat and

Silver Plating | Optical Coatings | Silver Electroplating | ASTM B 700

Silver Plating Without a doubt, Silver is one of the most popular finishes in the optical industry. With unique qualities such as it's

Package Shell for Optical Communication Modules Market

The Package Shell for Optical Communication Modules Market worth USD 1.89 billion in 2026 is growing at a CAGR of

Electroplating Capabilities

Electroplating, also known as Electrodeposition, is a highly valuable manufacturing process used to alter surface properties of optical

Aluminum shell processing for optical modules: Construction of a “zero ...

The aluminum shell, as the core load-bearing and protective component of the optical module, plays a crucial role in

TI DLP® System Design: Optical Module Specifications

This document focuses on projection optical modules that incorporate Texas Instruments' DLP Display chips and are designed to

Contact Us

Continue your research online:

Website: <https://rivomultitrade.co.za>

Technical inquiry: <https://rivomultitrade.co.za/contact.html>

This document is for preliminary research. Verify specifications against current standards, product documentation and project requirements.

