NBPF-2R Optical Thin-Film Deposition System – Specification

1. Overview

The NBPF-2R is a high-precision vacuum deposition system designed for advanced multilayer optical coatings used in optical communication devices, including edge filters, beam splitters, and AR coatings. It incorporates an 80-point optical monitoring system to achieve ultra-high accuracy in multilayer film thickness control.

2. System Performance

2.1 Vacuum Performance

- Rough pumping: From atmosphere to 7 Pa within 15 minutes
- Ultimate pressure: ≤ 7×10^{-5} Pa
- Pump-down: From atmosphere to 1.3×10^{-3} Pa within 20 minutes
- Build-up rate: 3×10^{-4} Pa·m³/sec *Measured at the ionization gauge inside the chamber under clean, no-load conditions.*

2.2 Substrate Heating

- Maximum temperature: 300°C
- Temperature uniformity: 200°C ±15°C (after 60 minutes)
- Heating method: Micro-sheath heaters
- Measurement points: 6 locations

3. System Configuration

3.1 Vacuum Chamber

- Internal dimensions: W1100 × D1285 × H1300 mm
- Material: SUS304 stainless steel
- Cooling: Water-cooled
- Front door: Two-section opening
- Viewing ports:
  - Substrate observation window
  - Evaporation source observation windows
  - Optical monitor windows (upper/lower)
  - Ion source window
  - Neutralizer window

- **Gauge ports: Ion gauge, Pirani gauges, Penning gauge, spare ports**

3.2 Substrate Rotation Dome

- **Dome diameter: 500 mm**
- **Rotation speed: 0–80 rpm**
- **Center-drive mechanism**
- **Adapter rings included**

3.3 Internal Chamber Components

- **K-type thermocouple for monitoring**
- **Baking heater system (12 kW total)**
- **Optical monitor glass heating system**
- **Anti-spatter shield plates (removable)**

3.4 Evaporation Sources

- **Electron-beam guns: Plasmatec G-12300 (two units)**
- **Power supply: D-10002**
- **High-index annular hearth (Cu)**
- **Low-index annular hearth (Cu)**
- **Closed-loop rotation control with encoder**
- **Quick-release shutters (two sets)**

3.5 Ion Source

- **Optorun RF ion source (17 cm)**
- **RF neutralizer**
- **Gas lines: O_2 and Ar**
- **Dedicated controller and RF power supplies**
- **Shutter mechanism included**

3.6 Uniformity Correction Plates

- **Two correction plates installed at upper chamber positions**

3.7 Optical Thickness Monitoring System (HOM2)

- **Measurement method: Reflection**
- **Wavelength range: 400–1100 nm**
- **Wavelength accuracy: ±1 nm**
- **Resolution: ≤2.5 nm**
- **Light intensity resolution: 0.001%**
- **Long-term stability: ±0.1%/h**
- **Communication: GP-IB (IEEE488)**

- **Components:**
  - **HOM2-F2 optical fiber system**
  - **HOM2-L1 high-intensity light source**
  - **HOM2-P stabilized power supply**
  - **HOM2-N1 spectrometer**
  - **Lock-in amplifier (SR510)**
  - **Signal conversion unit**
  - **80-point monitor glass exchange mechanism**

3.8 Quartz Crystal Thickness Monitor

- **Model: INFICON IC/5**
- **Sensor: 6-point rotary sensor (mounted on chamber ceiling)**

3.9 Gas Introduction System

- **APC system with RVG-040 controller and RME-010 valve**
- **Mass flow controller (300 sccm O_2)**

3.10 Vacuum Gauges

- **Combined gauge (CM-31) with Pirani and Penning sensors**
- **Ionization gauge (GI-M)**

3.11 Pumping System

- **Roughing pump: YM-VS-600C**
- **Diffusion pumps ×2**
- **Water-cooled baffles ×2**
- **High-vacuum valve**
- **Auxiliary valves**
- **Leak valves**
- **Polycold chiller (PFC-660)**

3.12 Cooling Water System

- **Automatic water purge for hearth**
- **Flow switches, solenoid valves, manual valves**

3.13 Compressed Air System

- **Filter, regulator, oiler**

3.14 Recorder

- **3-pen chart recorder**

3.15 Automatic Deposition Computer System

- **Full automatic sequence from pumping to deposition**
- **Dedicated control software**

- **Computer + display**

3.16 Control Panel

- **Touch-panel operation**
- **LCD size: 11.3 inches**

4. Accessories and Spare Parts

Includes: Shield plates, shutter plates, filaments, quartz crystals, window glasses, annular hearth parts, HOM lamp, HOM socket, 6-point sensor holder, etc.

5. Safety Features

- **Automatic shutdown for low air pressure**
- **Automatic shutdown for insufficient cooling water**
- **All valves close during power failure**
- **Emergency stop buttons**
- **Interlock protection for ion source, E-gun, and gauges**

6. Installation Requirements

- **Power: 68 kVA, 3-phase 200 V**
- **Cooling water: 120 L/min**
- **Compressed air: 0.5 MPa**
- **Installation space: W4500 × D7500 × H4300 mm**
- **Weight: approx. 5000 kg**
- **Room temperature: 15–25°C**

7. Scope of Supply

- **Design, manufacturing**
- **Factory acceptance test**
- **On-site installation and commissioning**

8. Acceptance Conditions

- **Vacuum performance test**
- **Temperature uniformity test**
- **Interlock and safety check**
- **Multilayer deposition test (~100 layers)**