

## Parylene Coating System Technical Specification

### 1. System Definition

This specification covers the technical requirements for the procurement of a Parylene Coating System capable of depositing Parylene N, C, D, and F (including VT4/AF-4) materials using the vacuum-based dimer vapor-phase polymerization process with fully automated control. The system shall be CE-certified, industrial-grade, and suitable for research laboratory use.

### 2. General Requirements

- The system shall be capable of coating Parylene N, C, D, and F materials.
- The system shall provide uniform coating on 3D structures and high aspect-ratio geometries.
- The coating thickness shall reach at least 30  $\mu\text{m}$ .
- The system shall include a vacuum chamber, dimer vaporizer, pyrolysis furnace, cold trap, vacuum pump, automatic control unit, and temperature-controlled lines.
- The system shall support fully automatic, semi-automatic, and manual operation modes.

### 3. Vacuum Chamber and Mechanical Features

- The chamber volume shall be at least 20-30 L and shall support wafers of at least 4" diameter.
- The chamber shall include a rotary (turntable) sample holder.
- The chamber door shall be heated or temperature-controlled, with a temperature stability of  $\pm 1-2$  °C.
- Soft-venting or equivalent pressure-controlled venting shall be available for sensitive samples.
- Internal chamber surfaces shall be constructed from stainless steel suitable for Parylene processes.

### 4. Vacuum System

- The system shall include an industrial-grade vacuum pump, either dry or oil-sealed, single-stage or multi-stage.
- The minimum pumping capacity shall be 16-20  $\text{m}^3/\text{h}$ .
- Achievable ultimate vacuum shall be  $1 \times 10^{-3}$  mbar or better.
- The system shall include at least two pressure sensors (Pirani and/or capacitive manometer).

### 5. Cold Trap

- The system shall include an electro-mechanical or chiller-based cold trap.
- Cold trap systems operating without liquid nitrogen are preferred.
- The cold trap shall effectively capture monomers from the pyrolysis furnace before they reach the coating chamber.

### 6. Dimer Vaporizer and Pyrolysis Furnace

- The dimer feed unit and pyrolysis furnace shall be fully integrated into the system.
- The pyrolysis temperature shall be in the range of at least 650-750 °C.
- The pyrolysis temperature shall be digitally controlled with a stability of  $\pm 1-2$  °C.

### 7. Control Software and User Interface

- The system shall operate through a PC-based, fully automated control platform (Windows compatible).
- The touchscreen interface shall be at least 10 inches.
- The software shall include the following features:
  - Creation and storage of coating recipes/programs
  - Parameter-time graphing

- Data logging and export in Excel/CSV format
- Ethernet/USB connectivity
- Alarm, error logging, and maintenance reminders
- Interlock mechanisms for all critical conditions (door, temperature, pressure, etc.)

iv. At minimum, remote monitoring and technical service access shall be provided. Remote control capability is preferred if available.

#### **8. Safety**

- i. Emergency stop button
- ii. Door-locking interlock system
- iii. Overtemperature and overpressure protection
- iv. CE compliance

#### **9. Electrical Requirements**

- i. The system shall be compatible with the electrical infrastructure of Türkiye.

#### **10. Monitoring, Logging, and Reporting**

- i. The system shall record the following parameters:
  - i. Pressure
  - ii. Temperature
  - iii. Time
  - iv. Error and alarm logs

- ii. Recorded data shall be viewable and exportable via the PC interface.

#### **11. Delivery and Installation**

- i. The system shall be delivered complete with the vacuum pump, initial consumables (O-rings, basic filters, gaskets), cold trap, control software, sample holders, all cables, and operation manuals.
- ii. On-site installation, commissioning, and user training shall be provided.

#### **12. Warranty and Service**

- i. A minimum warranty period of 12 months shall be provided.
- ii. The supplier shall provide documentation guaranteeing on-site service intervention within 10 days in case of malfunction.
- iii. Spare parts and technical service support shall be available for at least 10 years.