

Assembly of Initiative Chemical Vapor Deposition Reactor for Manufacturing Functional Polymers

Project Objective

This iCVD setup is designed for manufacturing functional polymers for biomedical applications. Students were involved in assembling and redesigning the custom-built vacuum reactor. This included connecting and assembling various components such as delivery lines, heated tapes, pressure transducers, temperature controllers, and valves. Additionally, students worked on an electrical box, connecting temperature controllers to solid-state relays and various transducers to regulate the process during vacuum deposition.

Requirements:

- Base pressure of 10±5 mTorr
- Maximum base pressure leak rate of 10 mTorr/min
- Delivery lines have a uniform temperature of 170±5 °C
- Reactant jars have a uniform temperature of 150±2 °C
- Heating filament has a uniform temperature of 250±2 °C
- Substrate stage has a uniform temperature of 40±2 °C
- An enclosure is built around the reactor to protect vital components



Testing Process





Equipment: Electrical Control Box (top), Adjustable Power Supply (middle left), Temperature Controllers (middle right), PAC Display (bottom left), and Refrigerated Bath (bottom right)

- Electrical Control Box + PAC Display: Monitor & control reactant jars temperature.
- Adjustable Power Supply + PAC Display: Monitor & control heating filament. Temperature Controllers: Monitor & control delivery line and reactor heating wrap
- temperatures.
- Refrigerated Bath + PAC Display: Monitor & control substrate stage temperature.



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Monomer Jar A Temperature 2025/03/26 www.www.monorman.monorman.monorman.monorman.monorman.monorman.monorman.monorman.monorman.monorman.monorman.mono Time (min) Monomer Jar B Temperature 2025/03/26 Time (min)



Subsystem Analysis



Top left (Monomer Jars): System maintains both jars within 1°C of their 150°C setpoint.

Top right (Substrate Stage): System uses a refrigerated bath, heating filament and heating wrap to maintain a 40°C setpoint.

Bottom left (Delivery Lines): System keeps lines A & B withing 5°C of their 170°C setpoint.

Assembly & Fabrication

Electric feedthrough installation (left): Integrated thermocouples monitor substrate stage and heating filament temperatures.

Delivery line (middle): Wrapped in fiberglass-insolated thermal tape to heat chemical vapor, and K-type thermocouples are used for monitoring.

External subsystems (right): KF connections are used to withstand high vacuum of up to 10mTorr.





Team Members



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90° Connection Bracket 48in x 16in

Designing & Prototyping

