

Thermal Analysis Instrumentation:

1. **Thermogravimetric Analysis (TGA)** measures weight changes in a material as a function of temperature or time under a controlled atmosphere.

Specifications:

Temperature range: Ambient to 1000 °C,

Sample weight capacity: 750 mg

Weighing precision: $\pm 0.01\%$

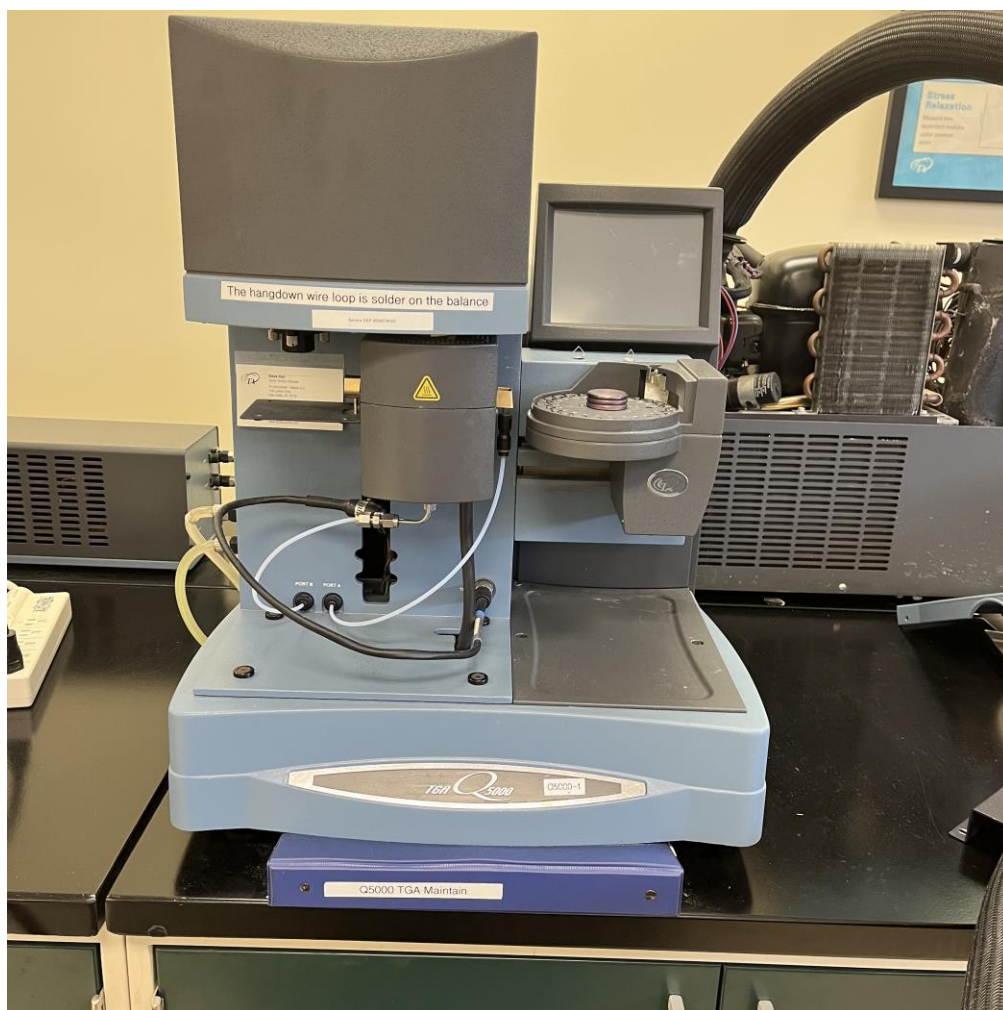
Heating rate: 0.1~500 °C/min

Weighing accuracy: $\pm 0.1\%$

Sensitivity: $< 0.1\mu\text{g}$.

Application:

- Thermal Stability of Materials
- Oxidative Stability of Materials
- Composition of Multi-component Systems
- Estimated Lifetime of a Product
- Decomposition Kinetics of Materials
- The Effect of Reactive or Corrosive Atmospheres on Materials
- Moisture and Volatiles Content of Materials



2. **High-Pressure Thermogravimetric Analysis (HP-TGA)**- is a specialty gravimetric analyzers designed to provide unique capabilities for high pressure and temperature under static or dynamic reactive atmospheres.

Specifications:

Temperature range: ambient to 1000 °C

Weighing accuracy: $\pm 0.0002\%$,

Sensitivity: 10 ug

Pressure limit: 50 bar

Weighing precision: $\pm 30\mu\text{g}$

Sample weight capacity: 60g

Application:

- Adsorption/Desorption Isotherms
- Pressure-composition isotherms
- Sorption/desorption kinetics
- Pressure/temperature cycling
- Coal gasification studies (using steam generator)



3. Differential Scanning Calorimetry (DSC): measures temperatures and heat flows associated with thermal transitions in a material.

Specification:

Temperature range: -180 to 600 °C.

Temperature precision: ± 0.01 °C

Calorimetric precision: $\pm 0.05\%$

Temperature accuracy: ± 0.1 °C

Sensitivity: 0.2 uW.

Calorimetric reproducibility: $\pm 0.05\%$

Application:

- Characteristic temperatures (melting, crystallization, transitions, reactions and glass transition)
- Melting, crystallization, transformation and reaction heats (enthalpies)
- Oxidative stability (Oxidative-induction time and oxidation onset temperature)
- Degree of curing in resins, adhesives
- Specific heat (Cp)
- Purity
- Production identification

4. **Pressure Differential Scanning Calorimetry (PDSC)** is a dedicated pressure DSC system that provides heat flow measurements on pressure sensitive materials from -130 to 550°C at pressures from 1 pa to 7 Mpa.

Specifications:

Temperature: -130 to 725 °C

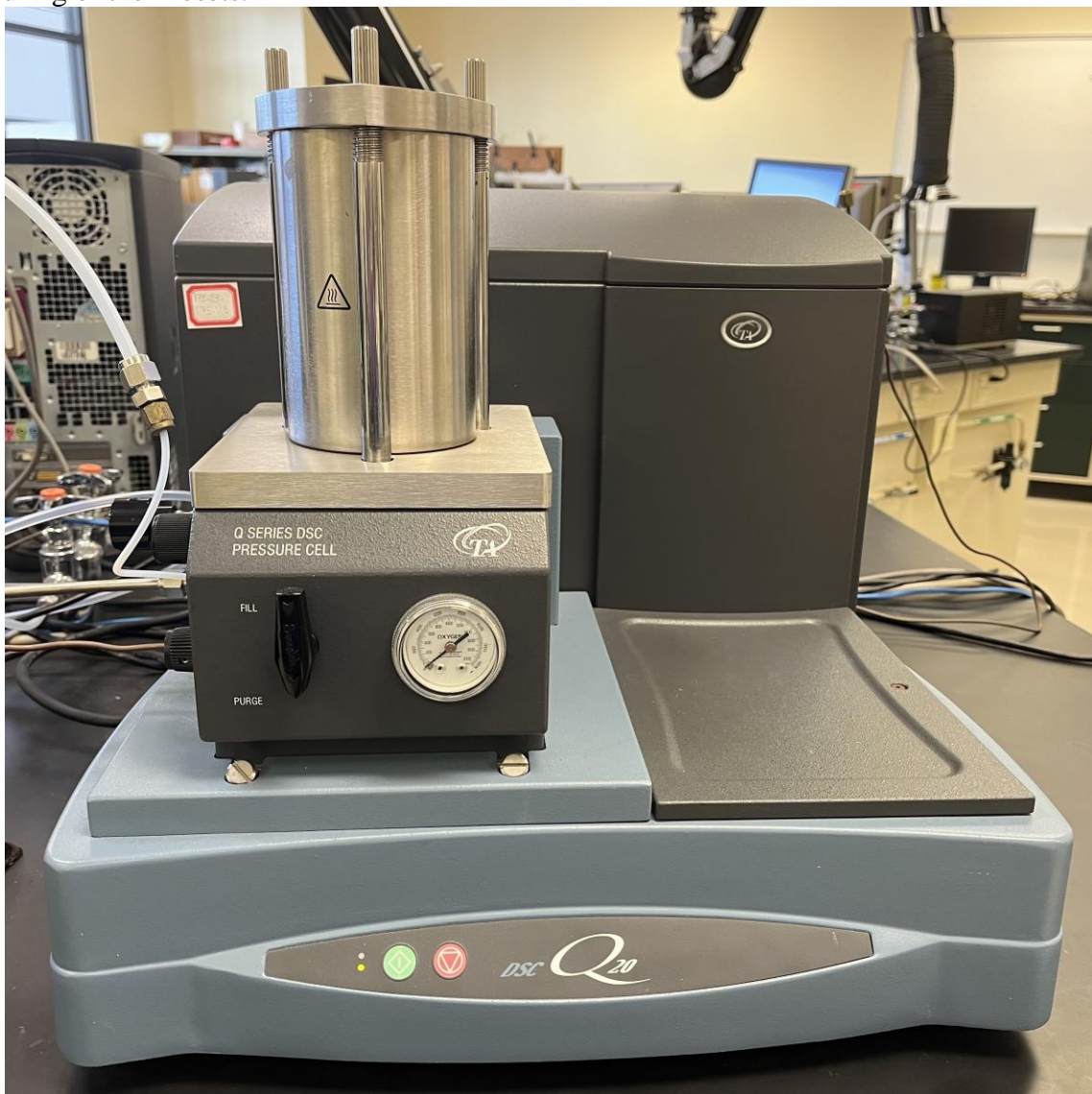
Pressure: vacuu to 7 MPa

Temperature accuracy: ± 0.1 °C

Temperature precision: ± 0.05 °C

Application:

- Determination of vapor pressure and evaporation heat
- Oxidation stability (Oxidative-induction time and oxidation onset temperature)
- Separation of reactions with overlapped evaporation
- Curing of thermosets.



5. **Simultaneous Thermal Analysis (DSC-TGA)** measures both heat flows and weight changes in a material as a function of temperature or time under a controlled atmosphere.

Specifications:

Sample capacity: 200 mg.

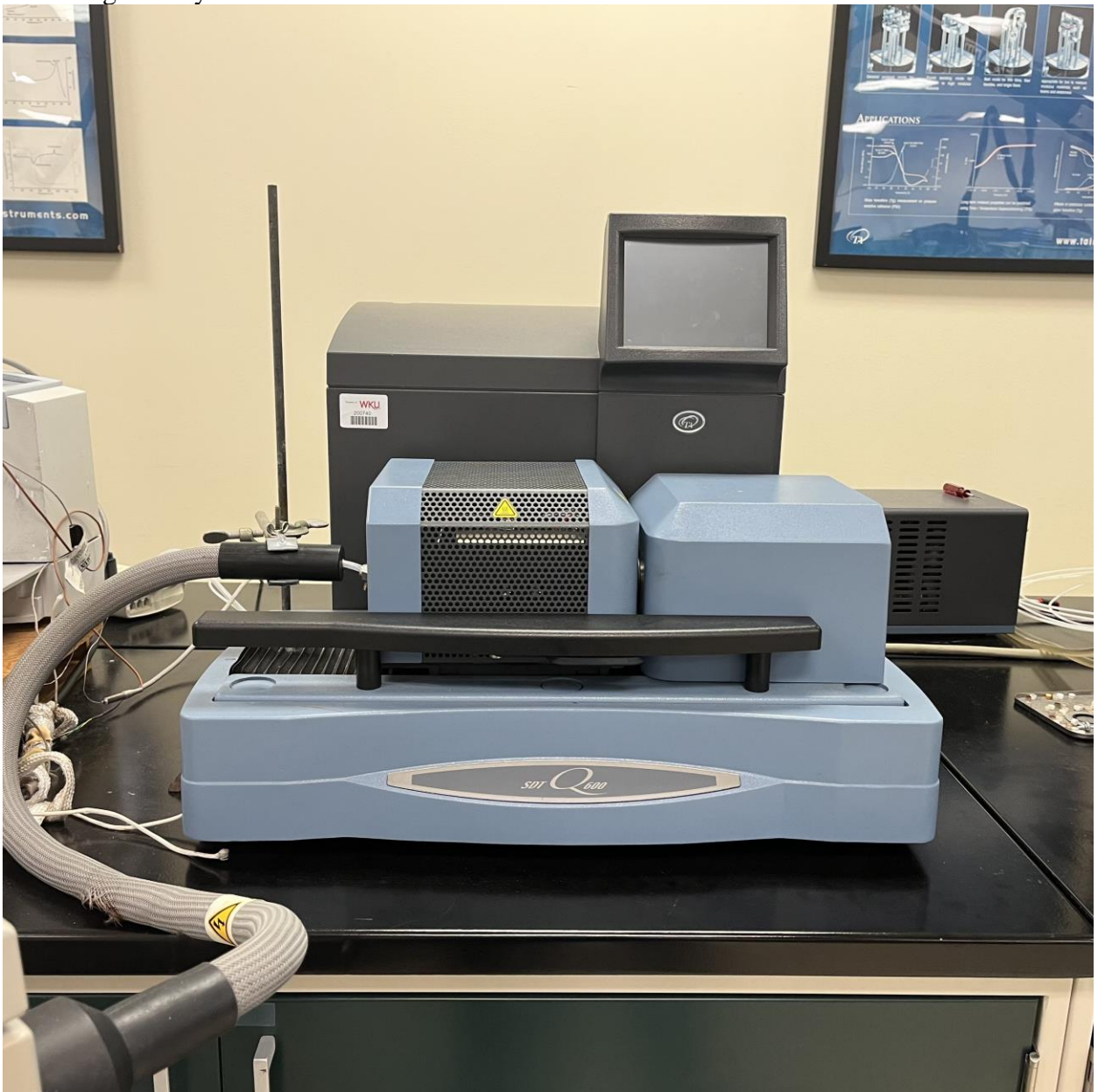
Temperature range: ambient to 1500 °C

Heating rate: 0.1 to 100 °C/min

DTA sensitivity: 0.001 °C.

Application:

- Thermal stability, oxidation, decomposition behavior, composition
- Determination of onset, peak, inflection and end temperatures,
- Phase transitions
- Evolved gas analysis with FTIR-MS



6. Dynamic Mechanical Analysis (DMA) measures the mechanical properties of materials as a function of time, temperature, and frequency.

Specifications:

Temperature: -150~600 °C

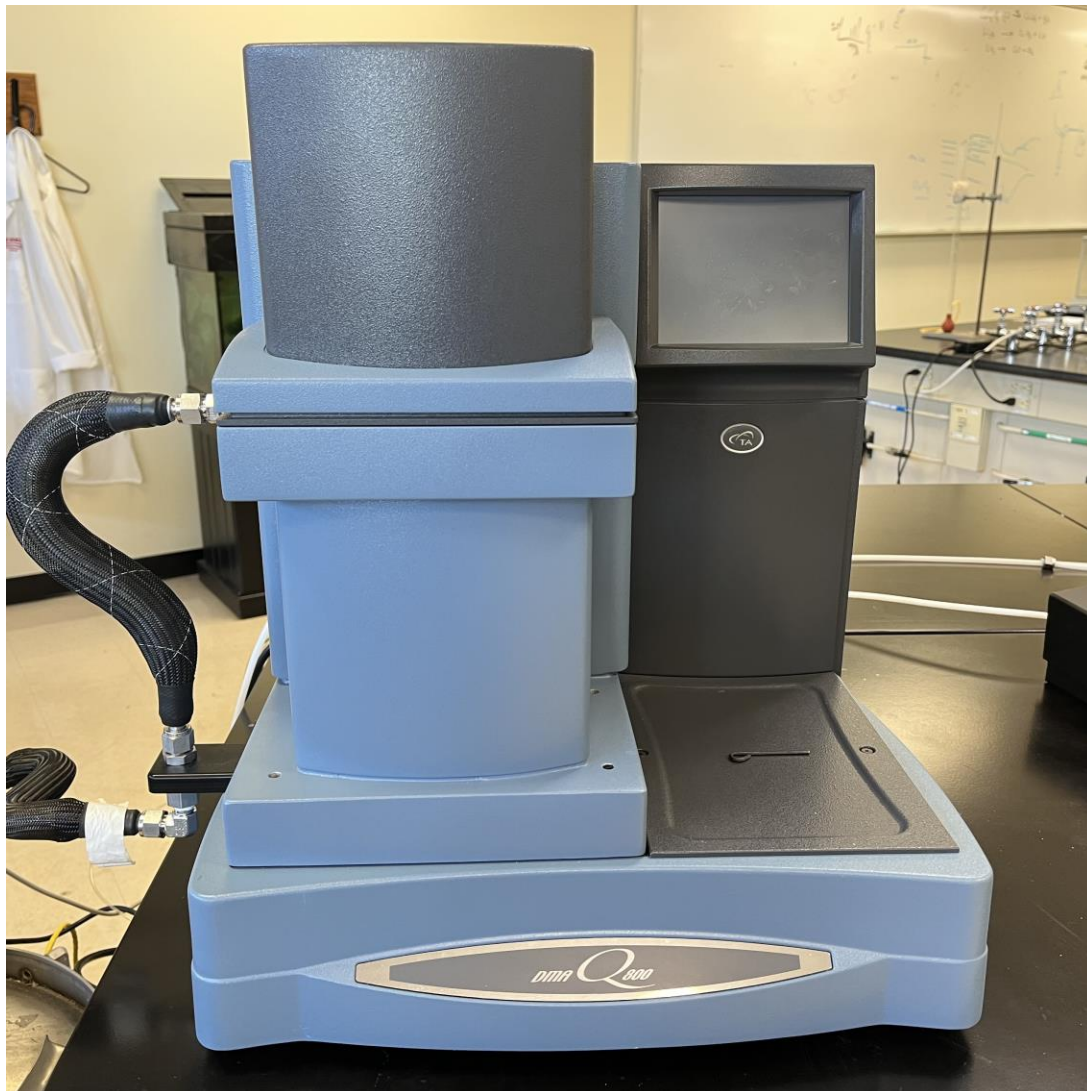
Force: 0.0001N~18N

Modulus range: 10^3 to $3 \cdot 10^{12}$ PA

Frequency range: 0.01 to 200 Hz

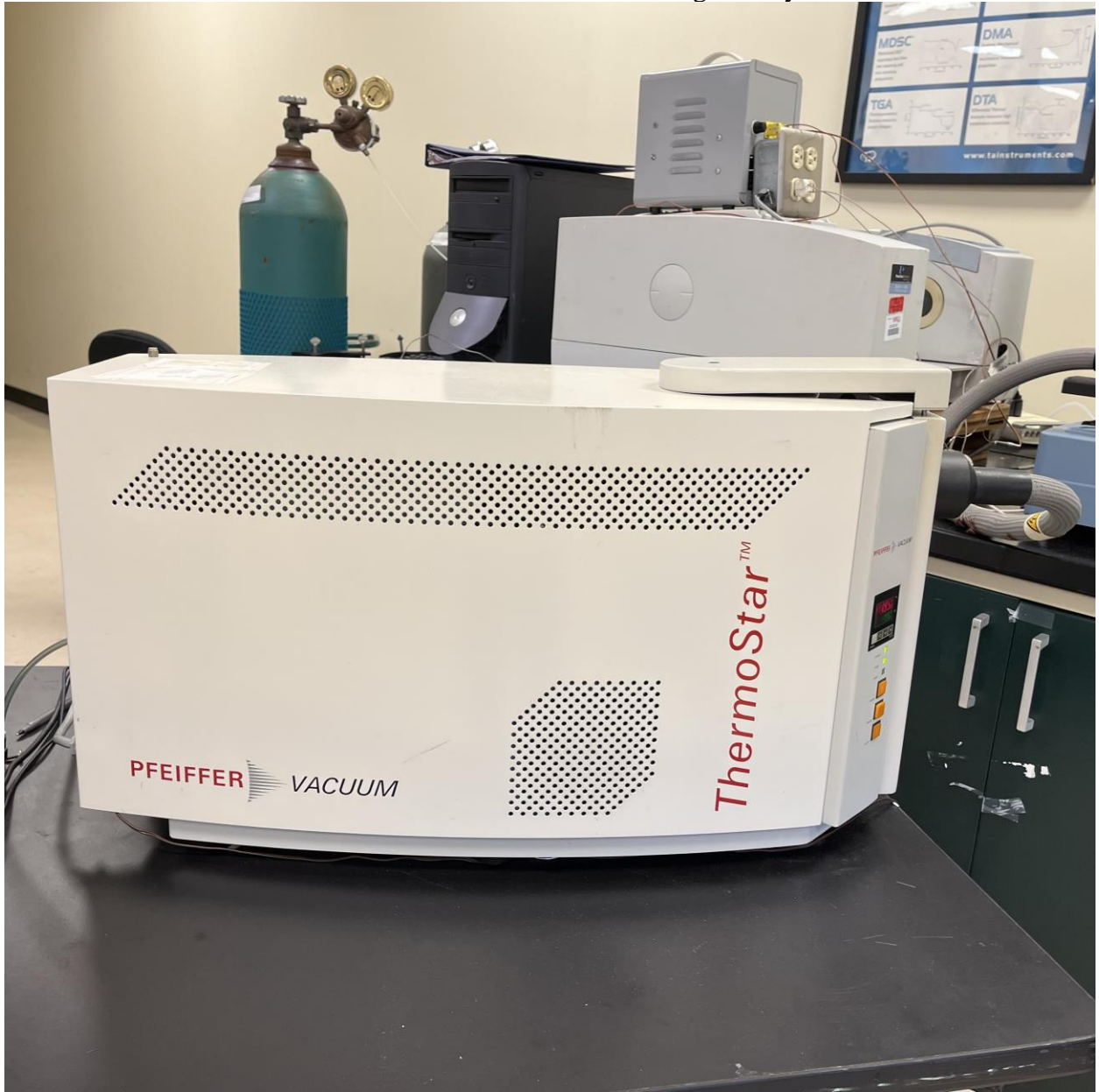
Application:

- Glass transition temperature
- Phase transitions
- Dimensional stability of parts at operating temperature and loading
- Damping capability of polymer
- Time-temperature superpositioning

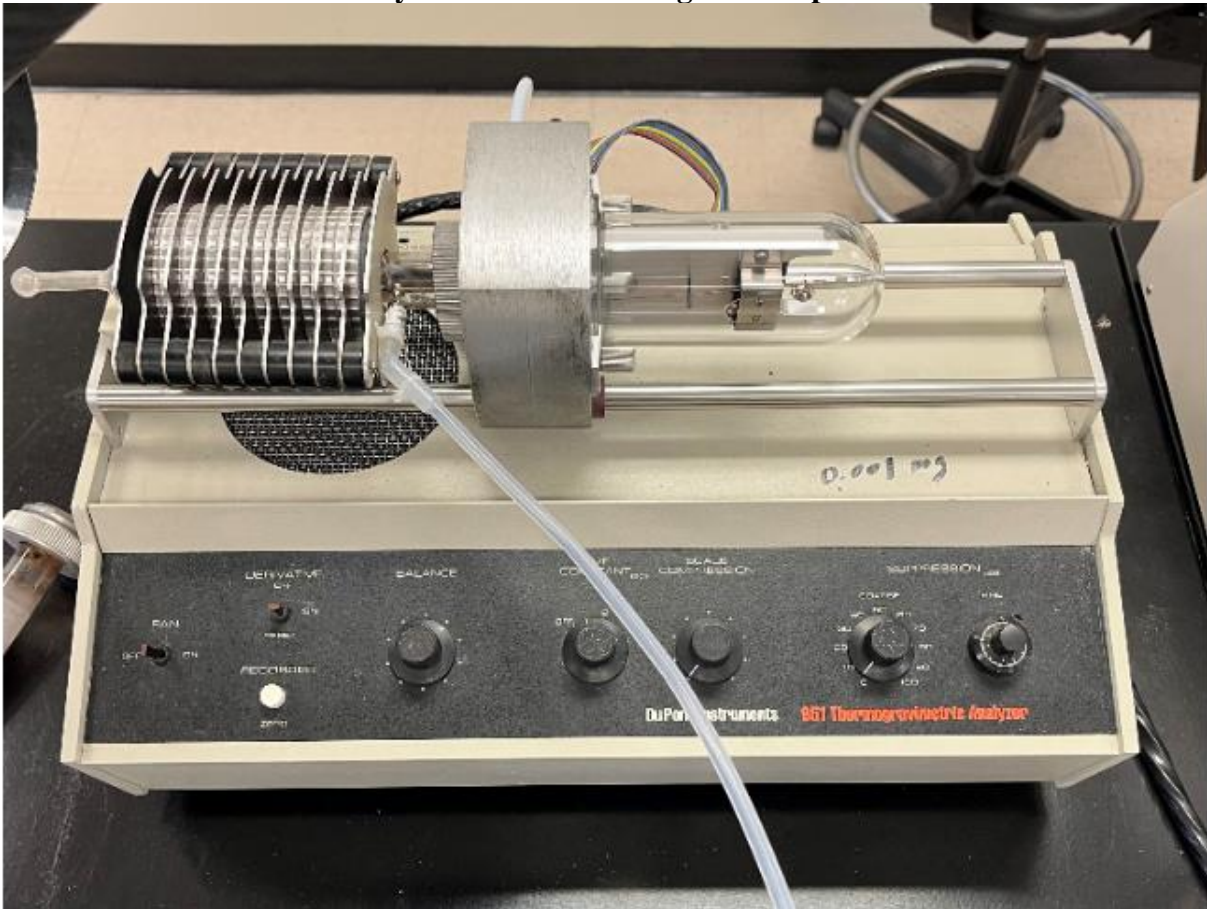


7. **FTIR and MS**

FTIR and MS are connected with TGA and SDT for evolved gas analysis.



8. TGA 951 is for TGA analysis under corrosive gas atmosphere.



Thermophysical Instrumentation:

9. **Dilatometer 802:** measures the dimension changes of a sample as a function of temperature or time. The DIL 802 allows this over a broad temperature range in well-defined atmospheres with very high resolution and accuracy. These tests are in accordance with the ASTM C372, ASTM E228, ASTM C531, ASTM E831, ASTM C824, ASTM D696, DIN 510145, DIN 51909, DIN 52328, DIN 53752, SEP 1680, SEP 1681 standards.

Specifications:

Change of Length: 4mm;

CTE accuracy: $0.01 \times 10^{-6} \text{ K}^{-1}$;

Temperature range: RT~1350°C.

Atmosphere: air, inert, reducing, vacuuming

Length resolution: 10nm;

Contact force: 0.02~1N;

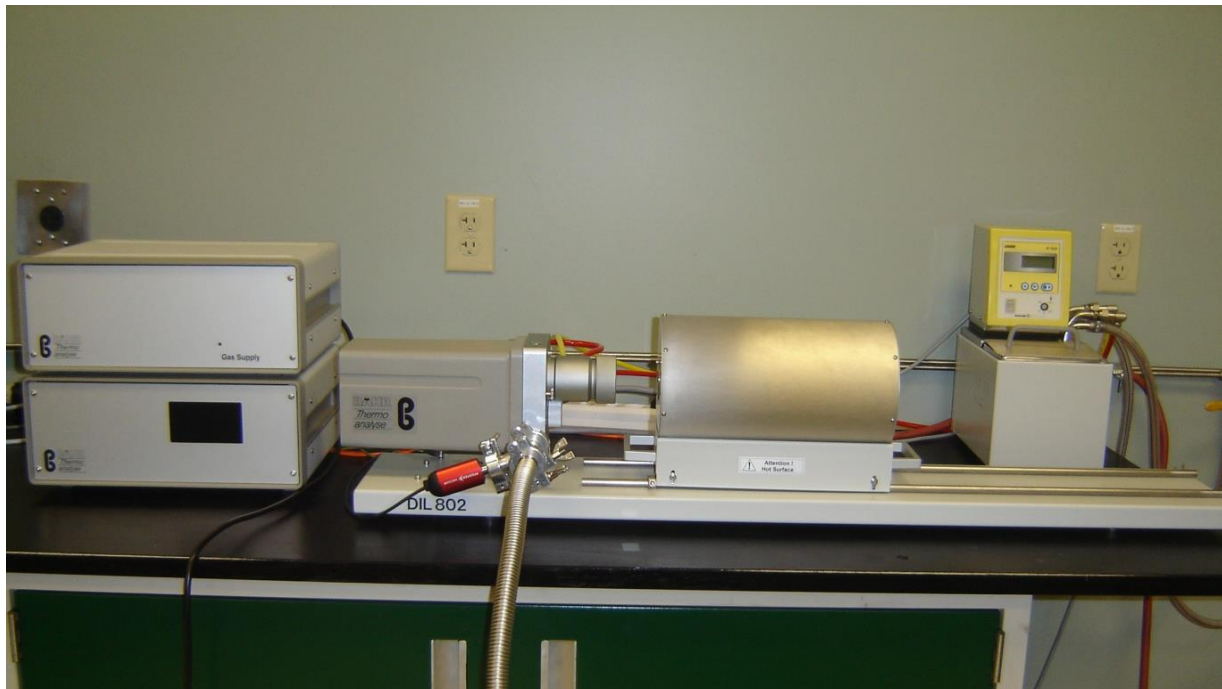
Temperature resolution: 0.05°C;

Vacuum: 10^{-4} mbar.

Applications:

- Linear expansion/shrinkage
- Glass transition temperature
- Densification and sintering process
- Heat treatment process optimization
- Softening point detection
- Phase transition process
- The influence of additives and raw materials
- Kinetics studies

Sample requirement: Length: 0~50mm ; diameter: max 7 or 10 mm



10. Guarded Heat Flow Meter –DTC-300 measures thermal conductivity of a variety of materials, including polymers, ceramics, composites, glasses, rubbers, some metals, and other materials of low to medium thermal conductivity. Non-solids, such as pastes or liquids can be tested using special contains. These tests are in accordance with the ASTM E1530 standard.

Specifications:

Thermal Conductivity range: 0.1~40 W/m.K; Accuracy: $\pm 3\%$
Thermal Resistance range: 0.0005~0.05m² K/W; Reproducibility: $\pm 1\sim 2\%$

Application: thermal conductivity from -20 to 300°C.

Sample requirement: 50 mm (diameter)×25mm (thickness)max or liquid



11. Flash Diffusivity System is a laser determines the speed of heat propagation by conduction during changes of temperature with time. It includes a multi-specimen indexed holder, supporting a variety of specimen sizes. The module includes an LN₂-cooled IR detector. The tests is in accordance with the ASTM E 1461, DIN EN 821, DIN 30905 standards.

Specifications:

Temperature range: RT to 1300°C;

Radiation source: Nd: Glass laser; Pulse width: 300 us to 400 us; Pulse energy: up to 35J;

Thermal Diffusivity range: 0.01 ~ 1000 mm²/s;

Thermal Conductivity range: 0.10~2000 W/m.K

Atmosphere: air, inert, vacuum

Application:

- Thermal diffusivity;
- Specific heat capacity;
- Thermal conductivity

Specimen Requirement: 12.7/25.4 mm(diameter)×6mm (thickness) max



12. Viscometer 403: measures the dynamic viscosity of materials with Newtonian behavior such as glasses, slags or mold powder. The instrument operates by measuring the shear stress and shear rate of a rotating bob immersed in a fluid filled cup under controlled temperature. Tests may be conducted in controlled stress or controlled rate conditions, and under isothermal or temperature ramp programs.

Specifications:

Torque range: 0.1~50 mN.m;

Temperature range: 25 °C ~1500 °C;

Rotor diameter: 9 mm;

Atmosphere: Air, inert gas.

Torque resolution: 2E-4 mN.m

Temperature solution: 0.1 °C

Angular velocity: max. 80 rad/s;

Application:

Viscosity: 10~10⁸ dPa s;

Sample requirement : 13.8 cm³



13. Discovery Hybrid Rhometer-2 measures both viscosity and viscoelasticity of fluids, soft solids. It is combined with magnetic bearing, drag cup motor, force rebalance transducer (FRT), optical encoder dual-reader, and True Position Sensor (TPS) into a single-head rheometer.

Specifications:

Minimum Torque Oscillation	2 nN.m
Minimum Torque Steady Shear	10 nN.m
Maximum Torque	200 mN.m
Torque Resolution	0.1 nN.m
Minimum Frequency range	1.0E-07~100 Hz)
Angular Velocity range	0~300 (rad/s)
Normal Force range	0.005~ 50 N
Temperature range	25~600 °C

Application:

- Viscosity of high viscosity liquids, pastes, and polymer solutions and melts
- Viscosity of LED encapsulant, solder paste, flux, underfill, die-attach adhesive, glob top encapsulant, etc for electronic packaging industry
- Curing profile of thermoset plastics and UV-curing adhesives and encapsulant
- Rheology of polymers
- Viscoelasticity of polymers

Sample requirements:

Viscous sample: 0.5~2 cm³.

Solid sample: 1~2 mm in thickness, 25 or 40 mm diameter.

