

Appendix A: Technical Specification
RFP 616596
Simultaneous Thermal Analyzer
March 2, 2021

Battelle Memorial Institute, Pacific Northwest Division, Management & Operating Contractor of the U.S. Department of Energy's Pacific Northwest National Laboratory (PNNL) for the U.S. Department of Energy (DOE) is requesting proposals for a Simultaneous Thermal Analyzer that performs thermalgravimetric analysis (TGA), differential scanning calorimetry (DSC) and differential thermal analysis (DTA) and evolved gas analysis by gas chromatography/mass spectrometry (GC/MS).

1.0 Simultaneous Thermal Analyzer Specifications

1.1 The equipment shall allow for simultaneous measurements on materials by thermogravimetric analysis (TGA), differential scanning calorimetry (DSC), and evolved gas analysis by gas chromatography/mass spectrometry (GC/MS).

1.2 The equipment shall provide simultaneous thermal analysis including TGA/DSC/DTA and TGA/DSC specific heat (Cp).

1.3 The equipment shall have a top-loading balance for durability with a high-resolution balance of resolution below 100ng and maximum sample range greater than or equal to 2 g including the sample crucible for TGA measurement. The balance drift must be less than 3ug/hr.

1.4 The equipment shall have a working temperature range less than or equal to -100 C and greater than or equal to 900 C.

1.5 The equipment shall have a wide range of heating/cooling rates (equal to or less than 0.005 K/min to equal to or more than 20K/min).

1.6 The equipment shall have an automatic sample carrier hoist to prevent users from damaging sensitive components.

1.7 The equipment shall be vacuum tight.

1.8 The equipment shall have software-controlled mass flow controllers with programmable tuning of the gas flow environment and flow rate throughout analysis.

1.9 The equipment shall have an autosampler to run at least ten (10) samples in a programmable fashion.

1.10 The equipment shall have software to program the autosampler to run without operators present and the software shall also allow for automatic evaluation on DSC and TGA measurements.

1.11 The equipment shall have a GC/MS with a turbo pump coupled to the TG system via a gas transfer line.

1.13 The equipment shall have established software for the GC/MS operation, including analysis of complex data that is generated and a NIST library for reliable and referenced identification of unknowns generated.

1.14 The equipment shall have a steel furnace with highly corrosion resistant Type P thermocouple sensor.

2.0 Additional Materials

2.1 A calibration sample kit (8 substances) shall be included. The calibration kit shall include the following substances: Indium, Tin, Bismuth, Zinc, Aluminum, Silver, Gold, Nickel for DSC/TGA calibration enthalpy and temperature. Required certificate of compliance for use in Al₂O₃ crucibles.

2.2 A set of standard samples for calibration measurements (Cp or Sensitivity/enthalpy) shall be included (sapphire discs each with a diameter consistent with instrument and the various thicknesses of 0.25, 0.5, 0.75 and 1.00 for use in Al₂O₃ sample crucibles. Discs require purity certificates).

2.3 A chemical material (e.g., Calcium Oxalate Monohydrate) is required to verify performance of thermo-balances for correct measurement of detected mass changes. The chemical material shall have a certificate of compliance.

2.4 A container designed for holding discarded lids at the conclusion of the analysis process shall be included.

2.5 A set of sample pans for use with instrument made of Al₂O₃ shall be included.

2.6 A set of covers for use with Al₂O₃ pans shall be included.

2.7 A set of sample crucibles for use with the instrument shall be included. Set shall be between 50-100 pieces.

2.8 A mechanical press is required for cold welding/pressure-tight sealing of crucibles.

2.9 A sample preparation set/kit is required for high temperature range sample analysis.