

Annexure - I

General Technical Specification of Heat Flux / Power Compensation Differential Scanning Calorimetry

Differential scanning calorimetry (DSC) is a thermo-analytical technique in which the difference in the amount of heat required to increase the temperature of a sample and reference is measured as a function of temperature. It is used to determine the phase transition behaviour like glass transition temperature, melting temperature of materials. It is also used to determine the crystallinity of a material.	
DSC measuring Technique	Heat Flux / Power Compensation. System must provide raw data without mathematical treatment.
Baseline Precision (-50 to 300°C)	< 30 μ W
Baseline curvature (-50°-300°C)	± 10 μ W or better
Heat Flow Resolution/Sensor resolution	0.1 μ W or better
Baseline Noise (-50°-300°C)	<1 μ W or better
Temperature range	-150 °C or lower to 600 °C or higher with Liquid nitrogen in Single Run
Furnace material	Must be corrosion resistant metallic furnace (Silver or platinum alloy)
DSC sensor	E/multiple type Thermocouple made of Au-Au/Pt/Pd or similar. The sensor must provide highest resolution and sensitivity of baseline.
Indium height/width	≥ 17 or better
Sample atmospheres	Air, helium, nitrogen, oxygen & argon with Mass flow controller (MFC) control. The instrument purge gas flow needs to be regulated by the electronic computer-controlled MFC. The MFC must allow for automated gas switching during an experiment.
Controlled heating rates	0.02 to 300 °C/min (or better) by Software control
Controlled cooling rates	0.1 to 50 °C/min (or better) by Software control with liquid nitrogen
Sensor time constant	1-2 Sec or better
Sampling rate	Up to 10 values/second or better
Temperature (°C) resolution	0.005 °C or better
Temperature precision	+/- 0.05 °C or better
DSC measuring range	+/- 350 mW or better
DSC Resolution	0.1 μ W or better
Enthalpy accuracy/precision	< 1%
Calibration standards	Set of certified calibration material for temperature, enthalpy and Cp.

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Special Calibration Feature	No need to recalibrate the system when using different heating rates or purge gases (inert to oxidizing atmosphere) in same experiment viz. OIT studies etc. All temperature calibration standards must be supplied. In addition, the vendor must provide a set of Certified Calibration material for temperature and enthalpy and Cp.
Software features	DSC system must include separate licensed software for complete experimental control, data acquisition and evaluation of routine features. Software must have the provision to evaluate peak temperature, onset temperature, enthalpy change, glass transition temperature, melting temperature, percentage of crystallinity, crystallization temperature, curing temperature, Specific heat (Cp). Software operated test procedure must follow the ASTM standard.
One Crimper set	One crimper set must be supplied along with the instrument for sample preparation. Crimper should be compatible of doing hermetic sealing of pans for liquid samples also.
Liquid Nitrogen Dewar	Suitable liquid Nitrogen dewar unit (min 50 Litre capacity Stainless Steel make) must be provided along with the System. The flow of liquid Nitrogen to the instruments must be controlled by Computer.
Crucibles	The system must be offered with 500 nos. of Aluminium sample pans with lids. Sample preparation tools must be included.
Manual	One set of operation manual with all details of parts must be supplied.
Application Support	Application Lab in India with qualified personnel to assist in case of application related queries must be mentioned in the bid document.
Training	The manufacturer/supplier of instrument should provide onsite training in both hardware and software to the laboratory personnel in the installation, operation and maintenance of the instruments.
Warranty and after sales service	The system must come with three years of comprehensive warranty on complete system. Turn around time must be attended within 72 hrs. The details of factory trained engineers need to be included in the technical bid. Product support and spares for period of minimum five years after warranty period, to be ensured by OEM.
Pre-installation requirement	Pre-installation requirements such as room size, required power rating, utility requirements are to be stated. Necessary environmental requirements, i.e., temperature, humidity etc. during the operation of the system must be clearly specified in the technical bid.

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QUALIFICATION & ACCEPTANCE CRITERIA TO BE MET BY THE SUPPLIER

1. The OEM / Supplier / Authorized Agent must determine the heat capacity and melting transition state with temperature of the standard samples during installation and commissioning with the supplied DSC equipment. The tested data must match with the value of standard specimen and only $< 2\%$ deviation is acceptable. If the performance criteria is not met during installation and commissioning, the consignment will be rejected.
2. The details of factory trained engineers and service centre locations preferably at Kolkata need to be included in the technical bid.
3. Proper printed catalogue in favor of the product must be enclosed with the bid.

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20/11/2020

Nripen Chandra
20/11/2020
[Signature]

Rakesh
20/11/2020