

## TECHNICAL SPECIFICATION OF HIGH PRECISION MICRO TENSILE TESTING MACHINE

### Key Features:

- The micro tensile testing system should have the ability to perform numerous mechanical tests of miniature and extremely small specimens over the range of 20mN to 2 kN.
- The system must have a ultrahigh precision drive system (**less than 25 nm position resolution**)for micro-position displacement control with high accuracy load measurement to perform tension, compression, shear and fatigue tests with utmost control and data collection performance.
- The machine should be capable of testing metals, metallic alloys, ceramics, composites, polymers, rubber, nanomaterials either in the standard or sub-size configuration within the load range.
- The system should have a dedicated high temperature chamber with a range of ambient temperature from subzero to 600 °C, to permit the study of temperature and stress relaxation in the mechanical behaviour.

### Important Technical features:

Sl No	Parameters	Values or Notes
1	<b>Types of tests to be performed</b>	Tensile, compressive, bending, fatigue (low cycle) and shear. <b>The supplied machine must have all required accessories as it is required for performance of the above mentioned tests.</b>
2	<b>Materials to be tested</b>	Metals, alloys, ceramics, composites, polymers and rubber in standard/sub-size sample sizes within the load range.
3	<b>Specimen Geometry</b>	<b><u>Sub-size specimen geometry</u></b> <ul style="list-style-type: none"> <li>• Gauge length: 2 mm to 8 mm (tensile/compressive)</li> <li>• Gauge width: 1 to 3 mm (tensile/compressive)</li> <li>• Thickness: 0.7 to 2 mm (tensile/compressive)</li> <li>• Total length: 7 to 12 mm (tensile)</li> <li>• Testing temperature: Ambient to 600 °C</li> </ul> <b>Note: The machine should be also capable of testing ASTM and ISO standard test samples (tension, compression, fatigue)</b>

<b>4</b>	<b>Temperature of testing</b>	<ul style="list-style-type: none"> <li>a. Room temperature to 600°C for both tensile /compression tests (preferable for an environmental chamber)</li> <li>b. Necessary grips/fixtures, push &amp; pull rods, specimen must be provided for holding the micro samples during testing up to 600 °C.</li> <li>c. Environmental chamber should have sufficient space for the small samples to be gripped inside the chamber &amp; tested.</li> </ul>
<b>5</b>	<b>Force range</b>	50mN to 2 kN or better
<b>6</b>	<b>Load cell accuracy</b>	1/1000 <sup>th</sup> of load cell capacity or better
<b>7</b>	<b>Position control resolution</b>	< 25 nm
<b>8</b>	<b>Position measurement accuracy</b>	± 10 µm over the entire length or better
<b>9</b>	<b>Actuator speed accuracy</b>	< 0.1% of set speed
<b>10</b>	<b>Data acquisition rate</b>	Up to 2000 points/sec simultaneous on load, extension/strain channels
<b>11</b>	<b>Testing speed range</b>	From 0.001 to 1500 mm/min
<b>12</b>	<b>Controller</b>	<p>The controller should have the following features:</p> <ul style="list-style-type: none"> <li>a. Analog to Analog/Digital converter at 35000 Hz Sampling Rate or better</li> <li>b. 32 Bit Digital Signal Processor with 2000 Hz data sampling rate or better</li> </ul>
<b>13</b>	<b>Compatibility with test specifications</b>	ASTM, ISO
<b>14</b>	<b>Stiffness of machine ( at testing height)</b>	Greater than 7 kN/mm
<b>15</b>	<b>Cyclic loading capability</b>	Mandatory
<b>16</b>	<b>Grips for holding tensile/fatigue samples</b>	<ul style="list-style-type: none"> <li>a. Pneumatic miniature grips with capacity of 2 kN with noiseless air compressor</li> <li>b. The grips should have capability to hold miniaturized, and standard (ASTM/ISO) specimens as per Sl. No. 3 and irregularly shaped specimens</li> </ul>
<b>17</b>	<b>Compression platens /anvils</b>	<ul style="list-style-type: none"> <li>a. 40 mm diameter or above, 2 Nos.</li> <li>b. The compression platens should be able to withstand temperature upto 250 °C or above.</li> </ul>
<b>18</b>	<b>Bend fixture</b>	<ul style="list-style-type: none"> <li>a. 3 point bend fixture for testing miniature or small specimens</li> <li>b. The fixture should be able to hold miniature/small specimens with length less than 6 mm.</li> <li>c. Testing temperature range: Room temperature to higher temperature (atleast</li> </ul>

		250 °C or above)
<b>19</b>	<b>Extensometer and strain card/gauge</b>	<u>Extensometer:</u> <ul style="list-style-type: none"> <li>Required extensometer (preferably 8 or 10 mm length extensometer) should be provided</li> </ul> <u>Strain gauge accuracy:</u> <ul style="list-style-type: none"> <li>As is required for the tests as per ASTM, ISO standards</li> </ul>
<b>20</b>	<b>Materials Testing Software</b>	a. Should have features for Windows-7/8 based graphical user interface b. The software package should have different application modules for tension, compression, shear/peel, and fatigue testing of different materials such as metals, plastics, composites etc. c. The module should include the following pre-configured test methods: ASTM E8-11, ASTM E21, ASTM F2516-07e2, ASTM A370, ASTM E517, ASTM E646, ASTM E345, BS EN 10002, ISO 6892, ISO 10113. <u>For cyclic test:</u> <ul style="list-style-type: none"> <li>Complex cyclic test sequences should be readily created by using test module waveform building blocks.</li> </ul>
<b>21</b>	<b>Equipment utilization</b>	Up to 24 hrs daily.
<b>22</b>	<b>Power Supply (Mains)</b>	220/240 V AC in single or three phases.
<b>23</b>	<b>Manuals</b>	Soft copy in .pdf format and 2 sets of hard copies.
<b>24</b>	<b>Computer, printer</b>	<ul style="list-style-type: none"> <li>Branded Computer system with necessary interfaces with the equipment.</li> <li>Laser Printer</li> <li>Related softwares</li> </ul>
<b>25</b>	<b>Supplier capability</b>	a. The supplier should provide the user list of the same model as well as the same series of machine sold in India. Please do not send all machines of all different models sold (irrelevant) b. The supplier should provide calibration/traceability certificate of the equipment as per National institute of Standards & Technology (NIST)/National Physical Laboratory (NPL) UK / United Kingdom Accreditation System (UKAS) preferably. c. The supplier must have supplied similar

		equipment to other national academic institutions or national research laboratories in India (list to be provided).
<b>26</b>	<b>Warranty period</b>	<p>a. Entire machine inclusively all systems/ accessories should be warranted for 36 months from the date of installation/commissioning.</p> <p>b. Supplier should make two free visits per year to IIT Madras facility as customer support program during warranty period.</p>
<b>27</b>	<b>Training</b>	<p>a. Supplier should provide necessary training to at least 5 persons designated by the customer in all types of testing (as mentioned in “<u>Types of test to be performed</u>” parameter) at the customer site at no extra cost.</p> <p>b. The specimens for training must be provided by the supplier.</p>
<b>29</b>	<b>Delivery Condition</b>	Equipment to be delivered in test ready, factory calibrated condition
<b>30</b>	<b>Bidders</b>	<p>a. Bidders should be direct manufacturer/subsidiary office in India or exclusive agent .</p> <p>b. They should have a good service support &amp; provide the service network in India.</p>
<b>31</b>	The system should be compatible for the following add on items.	
<b>A</b>	<b>Non Contact Video extensometer with integrated DIC</b>	A high end non-contact video extensometer with integrated DIC should be provided with related accessories. The DIC should use the camera of the video extensometer.
<b>B</b>	<b>Accessory for conducting shear test</b>	<p>Special attachments/fixtures for conducting tests to determine shear strength, bond strength and peel strength with high resolution/accuracy should be provided (especially to know the bond strength and peel strength of components like laminated composites, thin films, coatings etc.).</p> <p>Vendor should have sold this optional item (at-least one machine along with this fixture in any of IIT in India). The customers name, address &amp; contact number has to be provided.</p>

<b>C</b>	<b>Microscope or High speed camera</b>	The supplier should provide a stereo microscope or microscope or high speed camera with related compatible software and accessories which can be integrated with the micro-tensile tester to capture the microstructure during mechanical testing.
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