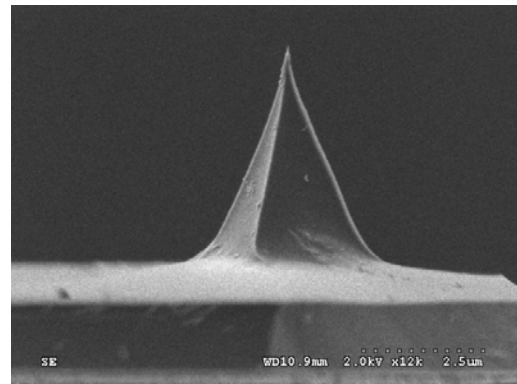


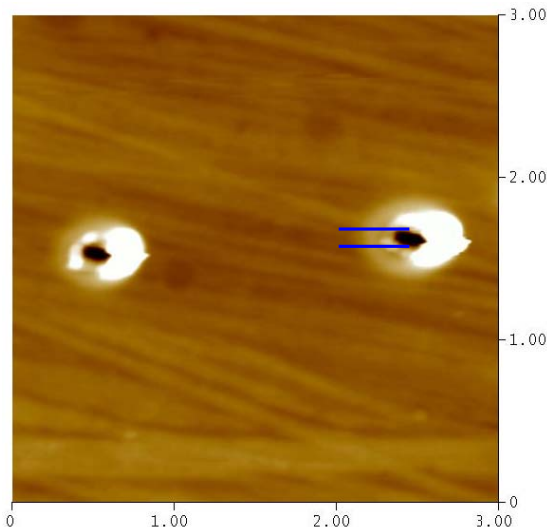
The nano-TA is an accessory (comprising hardware, software and probes) that enables a number of commercially available AFMs to perform sub-100nm local thermal analysis. Our breakthrough, batch fabricated, high resolution thermal probes enable the user to visualize the sample area at a typical resolution of better than 30 nm, identify the regions of interest and then position the probe using the AFM to subject the region in contact with the probe to a thermal ramp. The heating of the probe is due to a high resistance region incorporated into a traditional silicon probe allowing rapid, controllable heating up to ~500° C by controlling the voltage applied to the probe using the nano-TA electronics. During the ramp, the operator can monitor, using the included software, two of a range of signals available including the deflection of the cantilever, the resistance of the thermal probe or the power applied to the thermal probe. The deflection of the cantilever gives an indication of both thermal expansion of the sample and sample softening which can be a measure of phase transitions such as the glass transition temperature or the melting temperature. The local heating means the system is ideally suited to make measurements of thin films, polymer blends and nanocomposites in the polymer market. In the pharmaceutical market the system can be used to study spatial mapping of crystallinity, identification of amorphous / crystalline regions in a semi-crystalline sample, mapping of polymorphs, identification of components in compressed tablets and analysis of tablet coatings.



The nano-TA electronics comprising the power supply, TMA controller and CAL box.

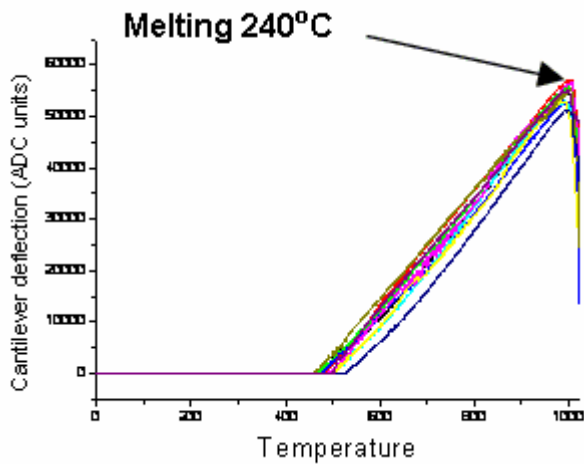
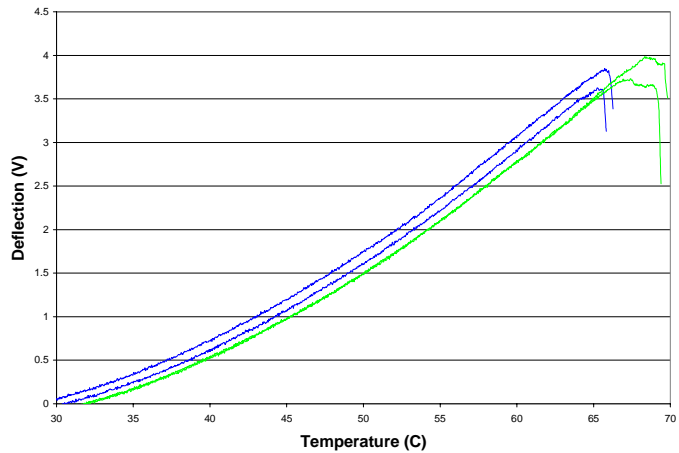


An SEM image of the silicon thermal probe showing aspect ratio and sharpness



Also, local heating allows a number of measurements to be performed on each sample because the probe is only affecting a very local region allowing characterization of the uniformity of the sample. Shown to the left is a 3 micron image of a molded polycarbonate sample. The sample was imaged in the contact mode, two locations were selected for a thermal ramp and the sample was rescanned. The two features in the middle of the image are the indents caused by the probe after its temperature passed the glass transition temperature of the polycarbonate. The two blue lines are approximately 90 nm apart and show the width of the indent.

The data shown to the right is from a polyethylene oxide (PEO) sample. The initial upwards deflection is due to thermal expansion of the sample and once the melting temperature is reached the probe penetrates into the sample. PEO has a melting temperature of approximately 65° C. The blue and green lines are from different locations on the sample and demonstrate the approximate 3° C temperature resolution of nano-TA. In order to determine the temperature of the probe, each probe needs to be calibrated. This is done with the calibration samples supplied with each system. These



samples cover a range of melting temperatures, are very homogenous and exhibit a sharp melting transition. Shown to the left is a zoom of multiple thermal ramps performed on the PET sample. As can be seen the measured melt temperature is very repeatable. Also the transition is very sharp due to the small end radius of the probe which allows accurate determinations of transition temperatures. The electrical characteristics of the nano-TA silicon probes are such that the system can ramp the probe temperature from room temperature up to ~500 ° C repeatedly in a controlled fashion.

The nano-TA gives polymer and pharmaceutical researchers the only tool for sub-micron local thermal analysis.

Features:

- System includes Software, Power Supply, TMA controller, CAL box, Bridge box, Calibration samples and five nano-TA silicon probes
- Probes come premounted for easy exchange and allow high resolution imaging and heating up to 500° C
- Rapid controllable Thermo-Mechanical Analysis with heating rates of up to 1,500°C / min.
- Identify/Characterize individual phases from their onset and peak temperatures and by measuring their thermal properties.
- Currently compatible with a number of commercially available SPMs, contact Anasys Instruments to see if your system will operate with nano-TA

System Specifications:

Temp. Ramp Rate: Up to 1500°C / min
Max. Temp. of Probe: 500°C (dependent on probe)
Imaging modes: Contact Mode/
 Oscillating Mode
 (dependent on SPM)

Probe Spring Constant: ranges from 0.1 N/m to 5 N/m
Probe Resonant Frequency: ranges from 20 to 50 kHz
Tip Radius: 10-20 nm
Tip Height: 1-5 microns