

New Agilent NanoSuite 6.0 Software Unprecedented Functionality for Nanoindentation and Tensile Testing

Data Sheet



New Features and Benefits

- Exclusive new test methods for polymers and substrate-independent thin film materials
- Standard batch of tests comprising 25 or more samples can be set up in 5 minutes or less
- Ability to plot 2D graphs and export directly to Microsoft Excel as viewed on monitor
- New data organization structure organizes sample files into projects and subprojects
- Microsoft Windows 7 (32-bit) compliance for current systems
- Convenient PDF printer to replace need for hardware printers

Applications

- Polymers
- Composites
- Thin film materials
- MEMS
- Stiffness mapping
- Scratch testing

Overview

The Agilent NanoSuite 6.0 software package offers the users of Agilent Nano Indenter G200/G300 and T150 UTM systems a variety of groundbreaking new test methods, including an unprecedented nanoindentation technique for making substrate-independent measurements of thin film materials and several novel techniques for testing polymers. NanoSuite 6.0 also provides new batch testing capabilities that are unparalleled in the industry, as well



Agilent Technologies

as flexible 2D graph plotting and exporting, intelligent data organization, Microsoft Windows 7 (32-bit) compliance for current systems, and a convenient PDF printer.

As in the package’s previous iteration, an intuitive interface allows users to set up and run experiments quickly — changing test parameters as often as desired — with just a few clicks. NanoSuite 6.0 offers support of small force/displacement measurements, from MEMS testing to tensile experiments, surface topology, polymers, and more. Versatile imaging capabilities, survey scanning, and streamlined test method development help researchers get from testing to results in record time.

Powerful New NanoSuite Methods

NanoSuite 6.0 offers researchers new prewritten test methods for polymers, along with improved scratch test methods. Another brand new NanoSuite 6.0 method gives researchers the unprecedented ability to make substrate-independent measurements on thin film materials quickly, easily, and confidently via nanoindentation. Supported exclusively by Agilent instrumentation, this novel technique is ideal for evaluating the elastic modulus of hard samples on soft substrates, or soft samples on hard substrates. The new method is able to extract the film modulus from the measured substrate-affected modulus, assuming that the film thickness and substrate modulus are known. It is applicable to a variety of film-substrate systems.

A NanoSuite method is a software file that contains the protocol for performing a test, analyzing the data, and generating an easy-to-read printed report. For example, a NanoSuite method may contain instructions to execute tests and

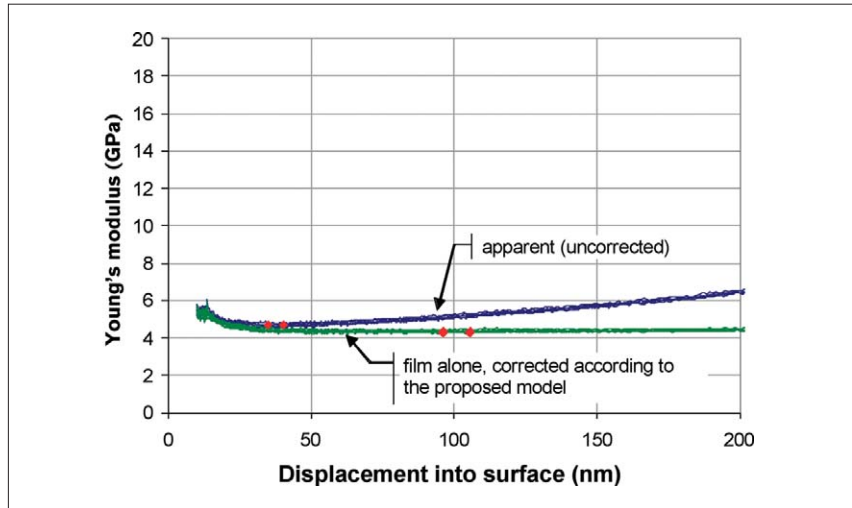


Figure 1. Low-κ 1 on silicon substrate, $t_f = 1007$ nm.

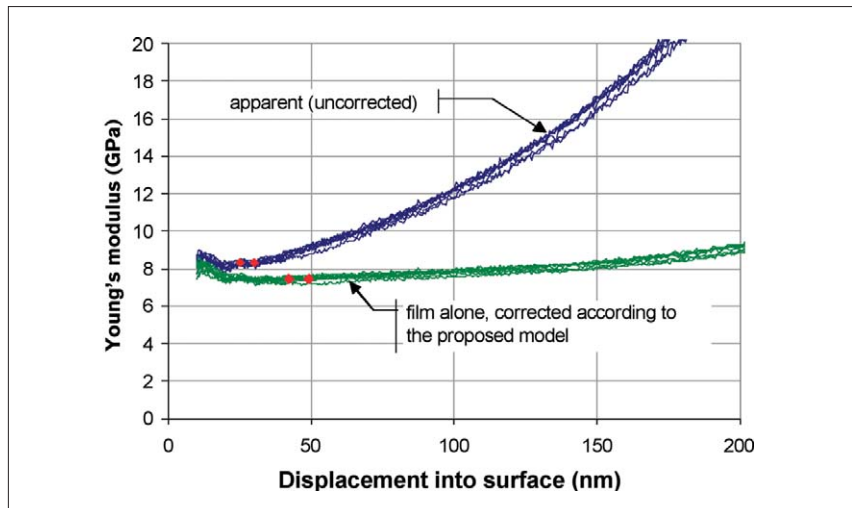


Figure 2. Low-κ 2 on silicon substrate, $t_f = 445$ nm.

1	2	3	4	5	6	7	8	9
			Results, standard			Results using new method		
Sample	N	Thickness nm	Range* nm	E_a GPa	$\sigma(E_a)$ GPa	Range** nm	E_f GPa	$\sigma(E_f)$ GPa
low-κ 1	8	1007	35-40	4.69	0.07	95.9-105.4	4.34	0.06
low-κ 2	8	445	25-30	8.23	0.13	42.2-46.8	7.46	0.12

Table I. Results

* Selected by eye

** Corresponds to 9.5%-10.5% of film thickness

Figures 1 and 2 show the Young’s modulus as a function of penetration depth for each sample. The blue traces are the values without any correction for substrate influence. The red diamonds show the range used to calculate the (uncorrected) Young’s moduli in the fifth column of Table 1. The green traces of Figures 1 and 2 are the values calculated according to the new method. The red diamonds, placed automatically at 10% of the film thickness show the range used to calculate the Young’s moduli in Table 1, Column 8 and are significantly lower than what was previously reported for these samples (Table 1, Column 5).

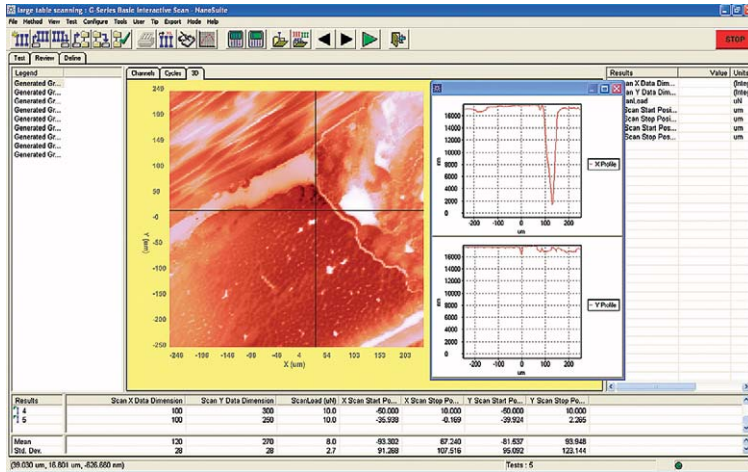


Figure 3. Original 500 x 500 μm survey scan. Carbon fibers are standing on end in the lower part of the image and in the upper left they are laying flat.

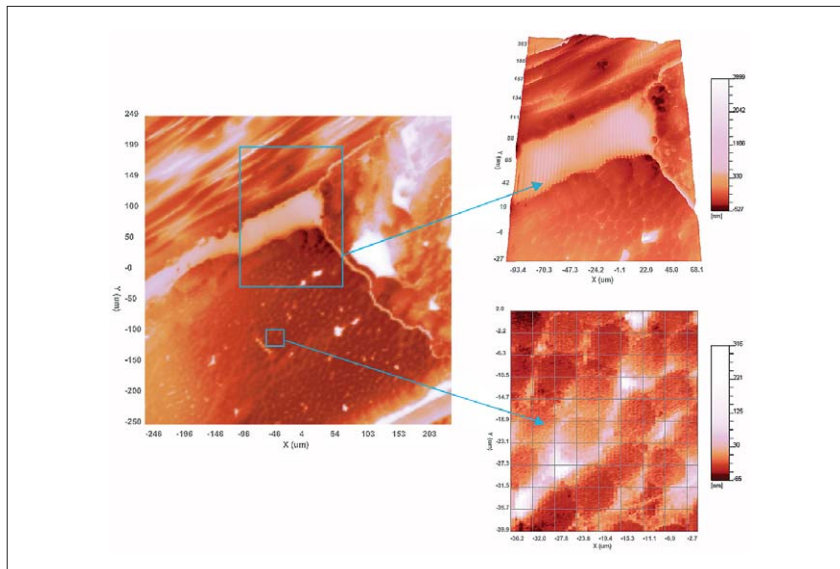


Figure 4. Left: 500 x 500 μm scan of carbon fibers over 18 μm of height deviation. Right top: 40 μm scan of feature shown in 3D. Bottom right: 40 μm scan of carbon fiber ends after polynomial leveling.

report results in compliance with ISO 14577, the international standard for indentation testing. A different method would be used to perform a controlled scratch test and report relevant results. NanoSuite Explorer 6.0 offers a simplified method-creation protocol that reduces the lines of code needed for customized test development. The variety of tests that can be designed within the NanoSuite environment is limited only by the researcher's imagination.

New Batch Testing Capabilities

NanoSuite 6.0 lets researchers quickly create new batches of tests for multiple samples. In addition to easily adding, editing, reviewing, or deleting samples, researchers can select a previously run batch of tests as a template for the current run. Utilizing this new NanoSuite 6.0 technique, a standard batch of tests comprising 25 or more samples can be set up in 5 minutes or less.

New 2D Graph Plotting and Exporting

Two-dimensional graphs can be plotted on the screen in NanoSuite 6.0 and then exported directly to Microsoft Excel: axis titles, scales, and all. This thoughtful functionality gives users the ability to export the graph they are viewing straight to Excel exactly as it appears on the monitor.

Versatile Imaging and Survey Scanning

NanoSuite 6.0 provides a wide array of imaging capabilities, including profile cross-sectional imaging, real-time adjustment of scanning parameters, polynomial distortion or leveling correction, plane-fit leveling, and a broad color palette.

For scanning of areas up to 500 μm x 500 μm, NanoSuite 6.0 offers a survey scanning option. Flatness of travel is 0.1% per 100 μm. This option is ideal for scratch and wear testing on large samples. It is also very useful for working with large samples that have irregular shapes, large samples composed of heterogeneous materials, and various metals, ceramics, and hard-coated materials.

Data Acquisition, Recording, and Control

The fundamental data acquisition rate for all Agilent Nano Indenters is 12.5 kHz. Acquired data is accumulated and averaged in an electronic buffer and recorded at a rate of up to 500 Hz. Even at the system's highest recording rate, NanoSuite 6.0 provides the power of real-time experimental control based on any recorded or calculated data channel. This allows functionality such as plotting real-time properties, or more complex capabilities, such as responding intelligently when a test sample fails.

Professional and Explorer Versions

The Professional version of NanoSuite 6.0 gives users access to test methods written by Agilent applications engineers, including the methods for testing in compliance with ISO 14577 and making substrate-independent measurements on thin film materials. Agilent is constantly developing and releasing new methods for users.

Nanoindentation instruments from Agilent Technologies conform to the ISO 14577 standard, delivering confidence in test accuracy and repeatability. These state-of-the-art solutions ensure reliable, high-precision measurement of nanomechanical properties for research and industry.

The Explorer version of NanoSuite 6.0 allows users to write their own NanoSuite methods using exactly the same software tools employed by Agilent applications engineers. In simulation mode, users can write test methods and process data analysis off-line. No other commercially available package offers this degree of flexibility and control.

Nano Mechanical Systems from Agilent Technologies

Agilent Technologies, the premier measurement company, offers high-precision, modular nano-measurement solutions for research, industry, and education. Exceptional worldwide support is provided by experienced application scientists and technical service personnel. Agilent's leading-edge R&D laboratories ensure the continued, timely introduction and optimization of innovative, easy-to-use nanomechanical system technologies.

www.agilent.com/find/nanoindenter

Americas

Canada	(877) 894 4414
Latin America	305 269 7500
United States	(800) 829 4444

Asia Pacific

Australia	1 800 629 485
China	800 810 0189
Hong Kong	800 938 693
India	1 800 112 929
Japan	0120 (421) 345
Korea	080 769 0800
Malaysia	1 800 888 848
Singapore	1 800 375 8100
Taiwan	0800 047 866
Thailand	1 800 226 008

Europe & Middle East

Austria	43 (0) 1 360 277 1571
Belgium	32 (0) 2 404 93 40
Denmark	45 70 13 15 15
Finland	358 (0) 10 855 2100
France	0825 010 700*
	*0.125 €/minute
Germany	49 (0) 7031 464 6333
Ireland	1890 924 204
Israel	972-3-9288-504/544
Italy	39 02 92 60 8484
Netherlands	31 (0) 20 547 2111
Spain	34 (91) 631 3300
Sweden	0200-88 22 55
Switzerland	0800 80 53 53
United Kingdom	44 (0) 118 9276201

Other European Countries:

www.agilent.com/find/contactus

Product specifications and descriptions in this document subject to change without notice.

© Agilent Technologies, Inc. 2011
Printed in USA, February 9, 2011
5990-4210EN RevB



Agilent Technologies