Agilent Lithography and Nanomanipulation Package, CAD-Based Software for the Agilent 5500, 5400, and 5100 AFM/SPM

Data Sheet

Features and Benefits

- CAD-based drawing program offers user-friendly interface for easy operation
- Ability to design and save shapes for reuse helps conserve time and effort
- Ability to control parameters such as force or probe bias increases utility
- Ability to work "on-the-fly" or through scripts provides enhanced flexibility
- Move-tip tool provides real-time lithography
- Visual Basic® Scripting enables custom, programmable lithography
- Seamless integration with Agilent's 5500, 5400, and 5100 AFM/SPM controller software offers simple upgrade path for AFM/SPM microscope users

Additional Capabilities

- Micro-machining via force variations
- Nano-patterning via probe bias and EC etching
- Nano-writing via surface potential controlled deposition and modification

Overview

Agilent's lithography and nanomanipulation software is a CAD-based package that provides a nanolithography tool for scanning probe microscopy (SPM) researchers. It allows users to sketch various shapes on a canvas (including lines, poly-lines, circles, and boxes) that can then be mapped to a real sample surface. Individual shapes can be assigned a unique set of parameters. Each parameter set is associated with a color for easy visual reference.

Accessible parameters include force, probe bias, sample bias or potential, and probe speed. As shown in Figure 1, a user-friendly interface enables the user to edit parameters and segment properties, such as start and end points and the order of execution. The software offers users the ability to cut and paste predesigned shapes to assist in the building of more complex patterns. Once designed, shapes can be reused in future experiments and are easily resized.

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Move-Tip Tool Applications

The move-tip tool provides a complete set of functions for nanomanipulation. With numerous parameter settings, such as force set-point or tip bias, the user can inscribe a line, inscribe a pattern, or manipulate particles in real time. (See Figures 2 and 3.)
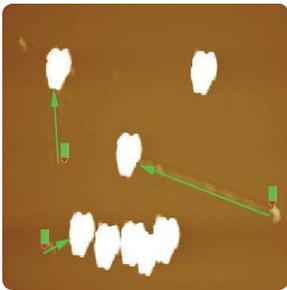

Figure 2. Making a smiling face with gold particles on a mica surface. Scan size: 2.5 µm x 2.5 µm.
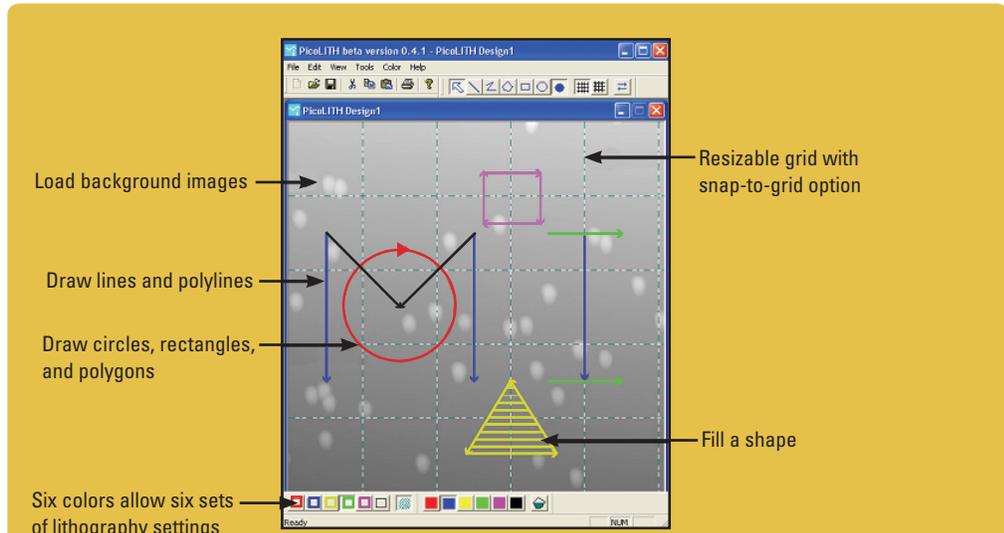

Load background images

Draw lines and polylines

Draw circles, rectangles, and polygons

Six colors allow six sets of lithography settings

Resizable grid with snap-to-grid option

Fill a shape

Figure 1a. Design canvas.
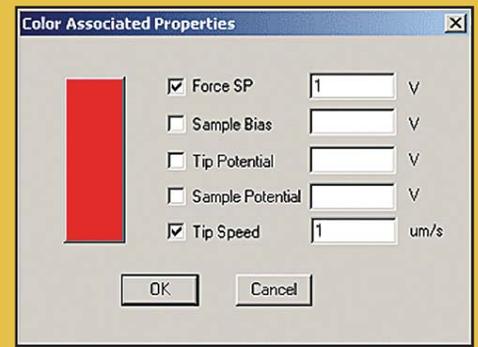

Figure 1b. Primitive property window.

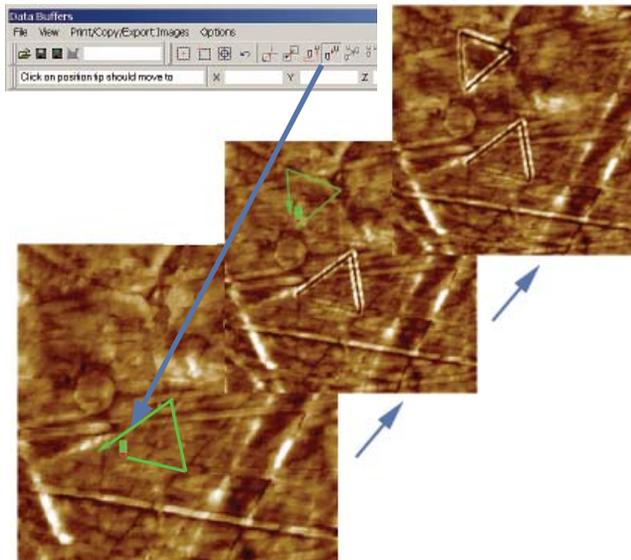**Figure 1c. Parameter settings window.**

Figure 3. Sequence of drawing triangles on CD blank surface. Green lines indicate the path of the tip movement in contact mode. Images are taken in AAC mode. Scan size: 5.5 µm x 5.5 µm.
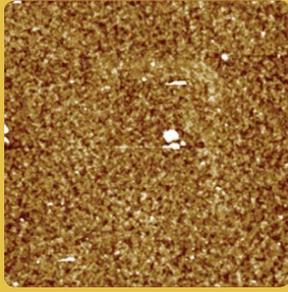
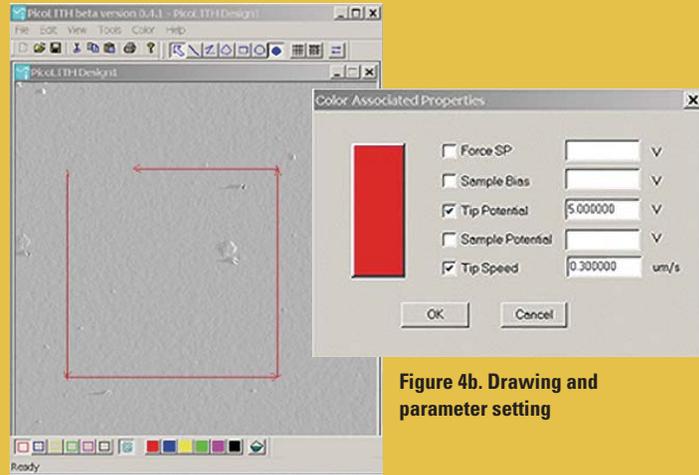Figure 4a. AAC mode topography image of PZT film
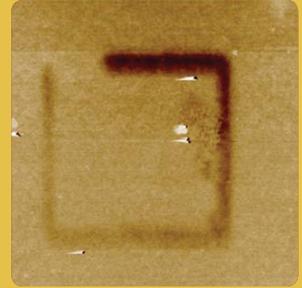Scan size: 14 µm x 14 µm

Figure 4b. Drawing and parameter setting

Figure 4c. EFM image after writing
Scan size: 14 µm x 14 µm.

Figure 4. Using Agilent's lithography and manipulation software to write with tip bias.

Visual Basic Scripting Applications

Agilent 5500, 5400, and 5100 AFM/SPM microscopes come with a 32-bit Windows® NT/2000/XP-based software package that incorporates Visual Basic Scripting capabilities. Visual Basic allows the user to program (via VBScript) most of the functions in the microscope software and define special sequences of desired action. By combining Agilent's closed-loop scanners and stages with VBScripting capability, the user is provided with a unique scripting tool for lithography applications. With predefined parameter settings (including STM/AFM tip bias, force set-point, and more), VBScripting makes drawing a line or a circle on the sample surface a straightforward procedure (Figure 4).
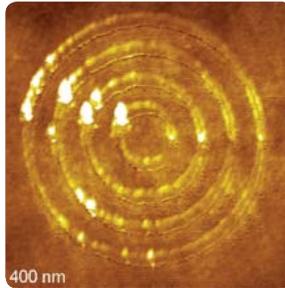

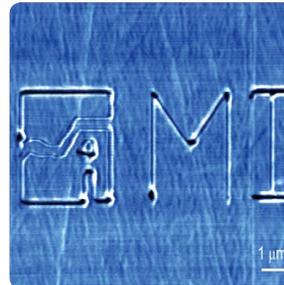Figure 5. Drawing circles on PMMA film.
Scan size: 2.5 µm x 2.5 µm.

Figure 6. Simple writing on a blank compact disc surface.
Writing speed: 0.3 µm/s.
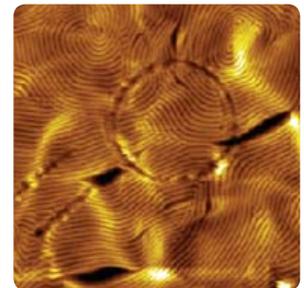Force: 2 V (uncalibrated).
Scan size: 12 µm x 8 µm.

Figure 7. Inscribing a circle and lines on a polymer film by increasing the tip-sample interaction force.
Scan size: 5 µm x 5 µm.

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