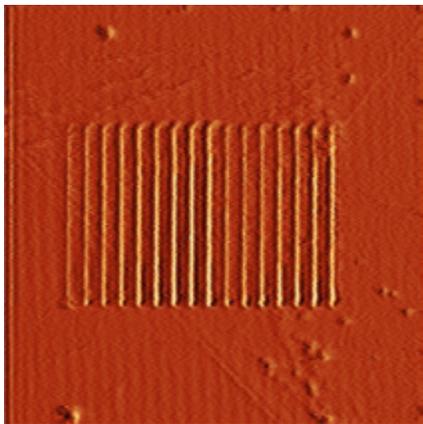


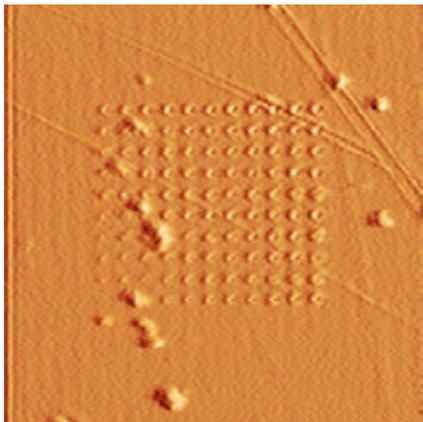
## Lithography Software Option

Model ID: LITHO

This **Lithography Software Option** is used for nanolithography. That is, the AFM's probe is used to alter the physical or chemical properties of the surface. Below are images of lines and indents made with an AFM probe on a PMMA surface.



*25 x 25  $\mu$  image of lines made in PMMA surface. Each line is 1  $\mu$  apart. Force of the probe on the surface was varied on each of the lines.*



*20 x 20  $\mu$  image of indents made in PMMA surface. Spacing between the indents is 1  $\mu$  and the force of the indents is increased from the bottom left to top right.*

The software uses a script of commands to move the probe in a pre-determined pattern over a surface. The two commands are: "movement" and "hold". During a movement and hold command, the voltage and force on the probe can be varied.

A MOVEMENT command consists of 5 numbers (no letters) separated by commas: They represent X, Y, Velocity, Setpoint%, and Z\_DAC voltage

- » X and Y are the coordinates in micron from the image plot.
- » Velocity is the speed from one point to the next listed point in nm/sec.
- » Setpoint% is the percent value of the existing setpoint.
- » Z\_DAC voltage is a voltage in the range of 0 to +5V which may be applied to the probe.

A HOLD command consists of 3 numbers (no letters) separated by commas:

They represent Setpoint%, Z\_DAC voltage, and Delay Time (ms)

- » Setpoint% is the percent value of the existing setpoint.
- » Z\_DAC voltage is a voltage in the range of 0 to +5V which may be applied to the probe.
- » Delay time(ms) is the time in milliseconds that the probe is held in its present position.

A scripting file is a text file that may be created with any program capable of outputting a .txt file. Each motion of the probe required to create the pattern must be added to the .txt file. Complex patterns may be created using a large number of movement and hold commands.

As with all AFMWorkshop software products, this software option is created using VI's in a LabVIEW™ environment and is integrated with the AFM Control software. The VI's used to create the software are available to customers who want to modify the lithography software and create new capabilities.

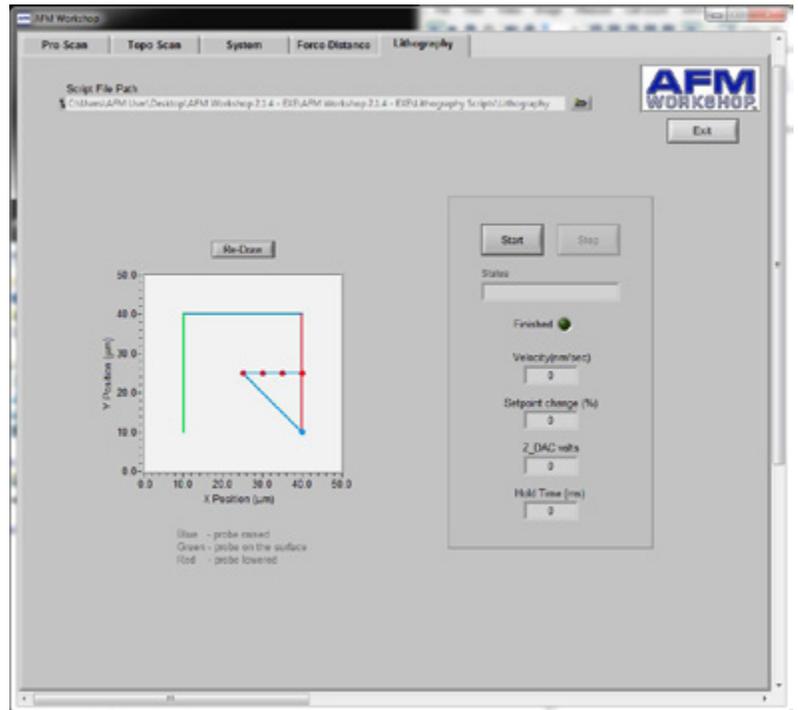
# EXAMPLE SCRIPT FILE

File Name:  
**Lithography.txt**

Description:  
**X, Y, Velocity, Setpoint%,  
Z\_DAC voltage  
Setpoint%, Z\_DAC voltage,  
Delay Time (ms)**

Script:  
**10,10, 20000, 100,0  
10,40, 20000, 100,0  
40,40, 20000, 50, 5  
40, 10, 20000, 110, 1  
100, 2.33, 2000  
90,5,1000  
25, 25, 30000, 50, 5  
101,5,20  
30, 25, 30000, 50, 5  
105,4,20  
35, 25, 30000, 50, 5  
110,3,20  
40, 25, 30000, 50, 5  
115,3,20  
100,3,20**

## ► Software



The lithography software window allows a user to load a scripting file. Once loaded, the pattern that will be made is displayed in an image window. When the start button is pressed, the script is implemented and the specifics of each step are listed in the window. A green light is displayed when the script is completed.

## ► Included with the option

- » PMMA sample
- » Manual
- » Plug for rear of unit.
- » Two probes:
  - AppNANO: Doped Diamond (DD-ACTA-5)
  - Conductive Diamond Tip – Non-contact mode probe
  - Material: Si, N-Type, 0.01~0.025 Ohm/cm
  - Cantilever: L= 125 µ, W=35 µ, T=4.5 µ
  - Tip Radius: < 150nm, Height: 14-16 µ
  - f: 200-400KHz, K=25~75 N/m