

High Aspect Ratio Structure – Deep Trench Nanometrology



XE-AFM employs a small, high-force stacked piezo ceramic for the Z-scanner, which allows for high speed control of the z-movement. The high Z bandwidth in turn enables the AFM to operate in true non-contact mode in ambient atmosphere. When imaging using true non-contact mode, the probe tip can not only sense the force at the apex of the tip, but also the force at the side of the tip. When the tip approaches to a steep sidewall, the tip will have proper feedback signal. Combining with the high bandwidth Z scanner, the tip can climb over the very steep and tall steps without breaking the sharp tip. This enables the excellent performance of XE-AFM in deep trench imaging and metrology.

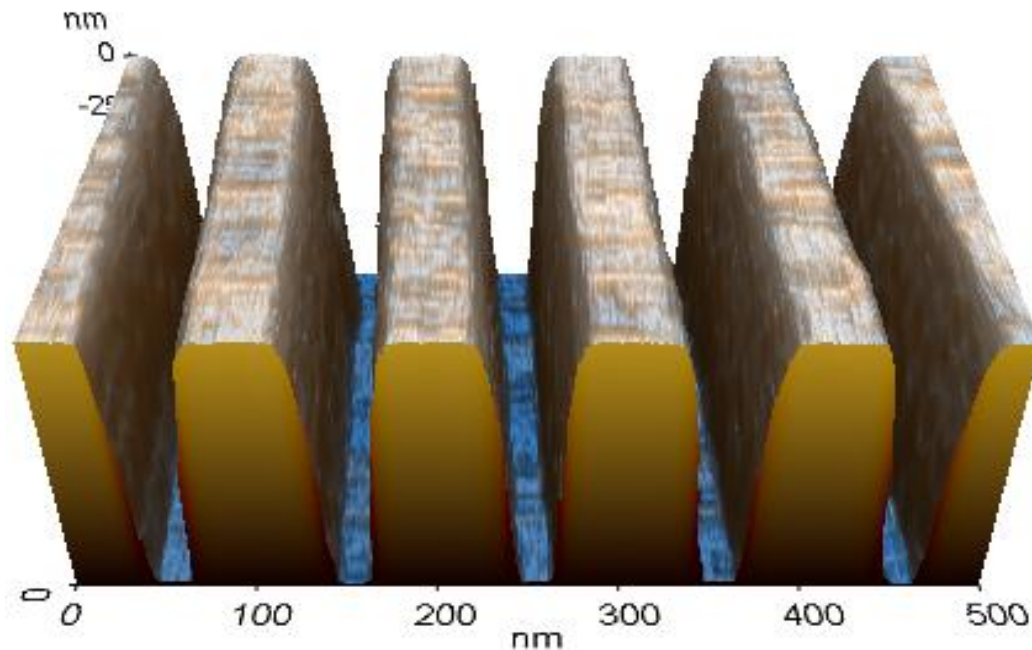


Figure 1 shows a 50nm wide silicon trench, with aspect ratio over 2 and sidewall angle over 85 degrees, can be very well imaged by XE-AFM, and the image shows a very clean profile. Because true non-contact mode is used, the tip stays sharp. So the same tip can be used to scan this deep trench sample over and over, and provide same resolution images.

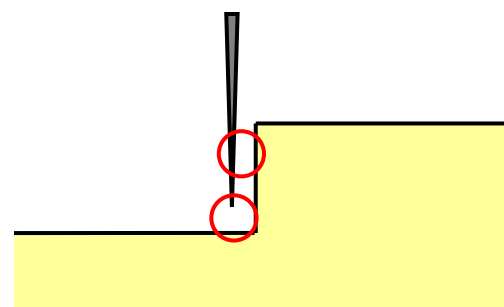
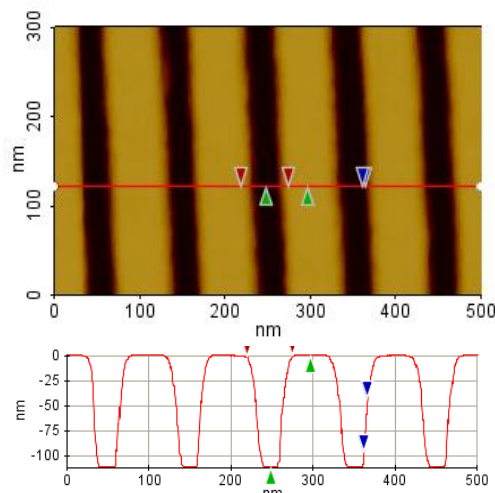


Figure 1. In true non-contact mode, the tip can sense the force on the side of the tip

Cursor	$\Delta X(\text{nm})$	$\Delta Y(\text{nm})$	Angle(deg)	
Red	55.249	1.375	1.426	TOP WIDTH
Green	48.343	112.736	66.790	DEPTH
Blue	4.144	53.604	85.580	ANGLE

Figure 2. A 50nm wide, 112nm deep trench can be very well imaged with XE-AFMs

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