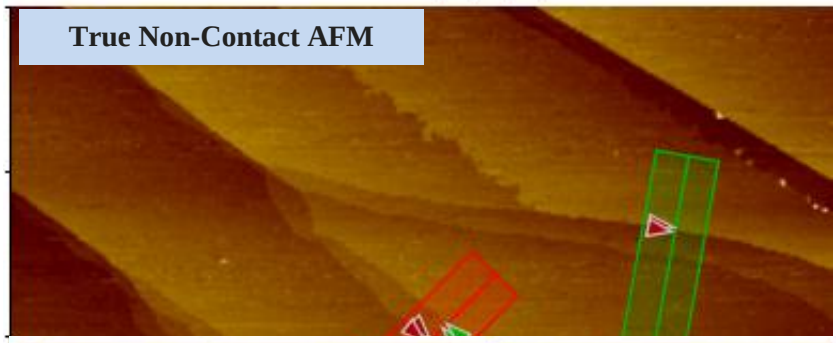
Graphene (Step Height) Metrology - (True-NC-AFM, Contact AFM and STM)

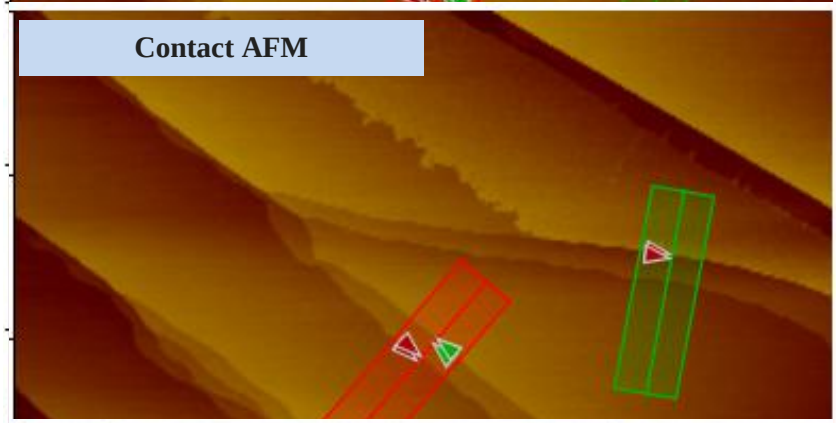
Sample:
Graphene **on SiC**
Courtesy of :
Georgia Institute of Technology.

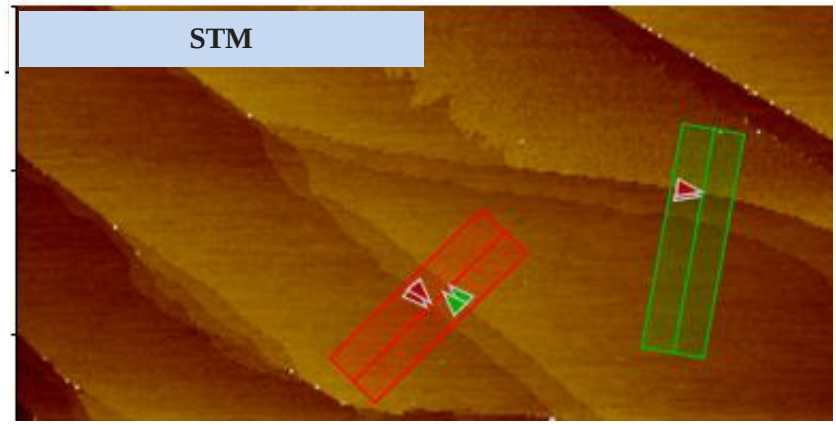
Image Conditions:
True Non-Contact
Contact AFM
STM
Scan size (5x2.5 um)
Scan rate (1Hz)
Z servo gain (1)
Pixel (512 x 512)

System Requirement:

True Non-Contact
Contact Mode
STM
Decoupled XY closed loop Scanner
Flexure Guided Z scanner with fast Response (10kHz)







Graphene is a sheet of carbon atoms bound together with double electron bonds (called a sp^2 bond) only one-atom-thick. The atoms in graphene are densely packed in a honeycomb style crystal lattice. Graphene is extracted from graphite. Graphite itself consists of many graphene sheets stacked together.

It has been shown that step height measurements taken on graphene sheets show an inconsistency in the reported value. This inconsistency is seen both among different AFMs, as well as, when using different modes on the same AFM. With the XE-series AFM, inconsistency is removed. The images on the left are of Graphene on SiC imaged by True-Non Contact AFM, Contact AFM, and STM using the Park Systems XE-100. The graphene step height measurements show consistent results among the three modes.

	Non-contact Mode	Contact mode	STM
Red	0.275nm	0.274nm	0.276nm
Green	0.619nm	0.620nm	0.616nm

Relevant Publication Discussing AFM Height Effects

Journal: Ultramicroscopy 107 (2007) 275–280
Title: Cantilever dynamics and quality factor control in AC mode AFM height measurements
Authors: Liwei Chen, Xuechun Yu, Dan Wang,
System used: Asylum Research MFP-3D AFM

Abstract: We show that inconsistent-imaging dynamics, in which the cantilever oscillates in the attractive regime on substrate background but in the repulsive regime on sample, leads to artifacts in apparent height in AC mode Atomic force microscopy.

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