19p-D5-13

光励振式ＵＨＶＡＦＭによるラテラルモード化 ： 化学的同定法

An all-optical UHV atomic force microscopy for chemical contrast in lateral mode.

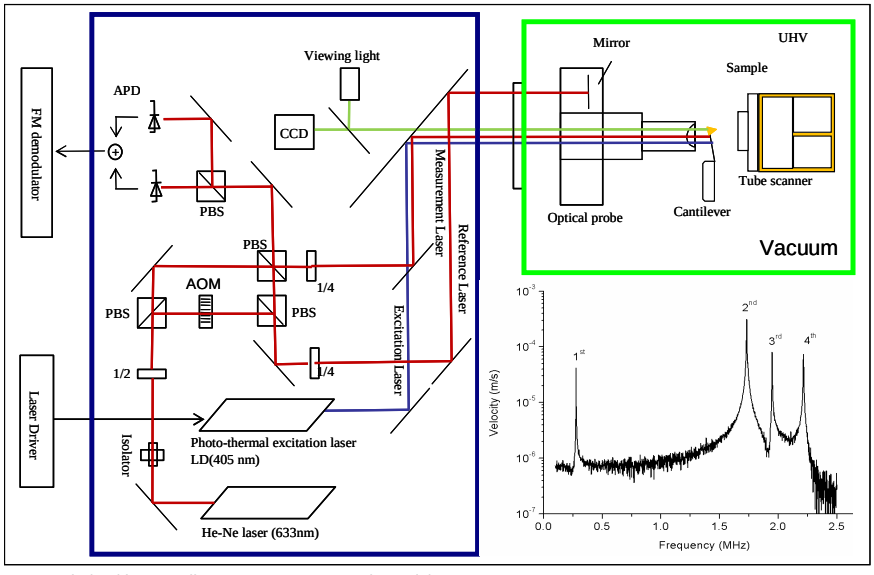
ダミロン ドゥニ [1,2], アラン ピエール [1,2], 鳥山 陽平 [1], 宮崎 雄太 [1], 小林 大 [1], 川勝 英樹 [1]

D. Damiron[1,2], Y. Toriyama[1], P. Allain[1,2],Y. Miyazaki[1], D. Kobayashi[1], H. Kawakatsu[1]

1. LIMMS, IIS, The University of Tokyo, Tokyo, Japan.

2. IIS, precision engineering, The University of Tokyo, Tokyo, Japan

The topic of this research is to develop real-time, high-resolution UHV-AFM with force gradient detection for chemical contrast capability. For this purpose, we are using a homemade ultrahigh vacuum dynamic force microscope incorporating a heterodyne laser Doppler interferometer and a superheterodyne circuit with an intermediate frequency of 10.7 MHz (Figure 1). The combination of laser Doppler interferometry and photothermal cantilever excitation offers extremely clean excitation of the AFM cantilever at low amplitude (10 pm) and high frequency (2 MHz) [1]. By applying multi-frequency modulation, small amplitude of drive and high frequency operation mode, clean gradient of frequency shift profiles can be obtained. Flexural resonance mode of a Si cantilever was used to detect the interaction between tip and Si(111) 7x7 surface and the structures could be correctly identified. We recently focused on the possibility to use the lateral mode of cantilever for its sensitivity toward the frictional properties of the surface. The gradient of frequency shift profiles and topography could also be obtained on multielements alloy samples. This technique can be useful for studying inhomogeneous alloys since it enhances contrast at the boundary between different compounds. We will report on these recently obtained results and discuss the main characteristics of this technique. The figure below represents the frequency spectra of a single-crystalline silicon cantilever obtained by photothermal excitation using a 405 nm laser-diode beam.



PBS: polarized beam splitter　AOM: acousto-optic modulator

Figure 1: Schematic of the optical/detection exitation system and frequency spectra of the cantilever.

[1] S. Kawai, H. Kawakatsu Applied Physics Letters, Vol.89, 2006.