DESIGN OF A LOW-TEMPERATURE ULTRA-HIGH VACUUM NON-CONTACT ATOMIC FORCE MICROSCOPE

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Abstract

With the aim to find new routes to investigate complex surface systems, the noncontact atomic force microscope (NC-AFM) has evolved as a complementary technique in the field of scanning probe microscopy and demonstrated to be a successful surface sensitive tool with remarkable achievements such as: atomic resolution imaging on various metallic, semiconductors and also insulating surfaces [1], atomic manipulation [2] and chemical identification of individual atom on surfaces [3].
In this contribution we present the design of a low-temperature (LT), ultra-high vacuum (UHV), NC-AFM using frequency modulation (FM) detection mode. Optical fiber interferometery is used for the cantilever dynamics detection. The microscope assembly consists of two distinct parts. A fixed base, directly coupled at the bottom of a liquid helium cryostat, and a mobile base suspended by springs and decoupled from the fixed base, which comprises coarse approach elements for sample and optical fiber [4].
The operation of the microscope at LT is enabled by the top bath cryostat and additional thermal shields directly connected to the helium and nitrogen reservoirs that completely surround the microscope. The integrated shutters and optical windows in the thermal shields allow *in situ* sample and cantilever exchange, molecular/atomic deposition and also the possibility of monitoring the coarse approach of optical fiber and sample even at low temperature. Special attention is paid to the vibration isolation system and to the materials used in the construction of the microscope.

References:

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