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Cryogen-free low temperature STM/AFM based on a closed cycle cryostat BYOUNG CHOI, STEFEN ULRICH, RYAN MURDICK, RHK Technology, Inc, RHK TECHNOLOGY, INC. TEAM — Closed cycle cryogenic scanning tunneling microscope (CCC-STM) and atomic force microscope (AFM) will be presented. By using He heat exchange gas, thermally linked and mechanically decoupled CCC-STM/AFM enables atomically resolved microscopy and spectroscopy on various surfaces. We will present the noise measurement of the tunneling current and the thermal drift analysis. Temperature as low as 14K on the sample and the tip-sample distance fluctuation as low as 2 picometer have been achieved from 9K cryostat after 8h of cooling time. Low thermal drift in a lateral direction ($<0.1\text{nm/hr}$) enables to get a scanning tunneling spectroscopy grid with more than 64×64 pixels which typically takes over 10 hrs. We will also present the high stability and reproducibility of the CCC-STM/AFM with the atom resolved imaging of Si, Pt, Au and KBr surfaces in STM and AFM mode. These results demonstrate that the developed CCC-STM/AFM is a versatile instrument enabling experiments on a variety of materials and surfaces at picometer resolution without using any liquid cryogen.

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