

## **Low temperature scanning probe microscopy at high magnetic fields in closed cycle systems: from 4 K down to mK**

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In view of the rapid increase of the costs for liquid helium, closed cycle cryostats are becoming of paramount importance in low temperature research. Sensitive techniques such as scanning probe microscopy (SPM) require specially designed products optimized for ultra-low vibrations. Combining the latter with high magnetic fields has become possible only very recently due to a proprietary (top-loading) design by attocube systems: mechanical vibrations created by the pulse-tube coldhead are decoupled from the measurement platform, resulting in peak-to-peak vibration amplitudes of less than 4.2 nm at the sample location, while retaining probe cooldown times as fast as 1 hour.

We present vibration spectra as well as examples of several different SPM techniques such as CFM, AFM, MFM, and SHPM at 4 K and up to 9 T. In addition, we show proof-of-principle SPM measurements in a dry dilution refrigerator at less than 100 mK.