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A Compact, Wide Temperature Range (300mK-300K) Magnetic Force Microscope using High Resolution Fibre Interferometer and Alignment-Free Cantilevers OZGUR KARCI, NanoMagnetics Instruments Ltd , MUNIR DEDE, Bilkent University, AHMET ORAL, Sabanci University, NANO-MAGNETICS INSTRUMENTS TEAM, BILKENT UNIVERSITY COLLABORATION, SABANCI UNIVERSITY COLLABORATION — We describe a design of a Low Temperature Magnetic Force Microscope (LT-MFM) for variable temperatures between milli-Kelvin temperatures to 300 K. The design of LT-MFM is very compact, 23.6mm ODx200mm, flexible and is compatible with almost any cryostat (included PPMS of Quantum Design Inc), even He3 systems or DR, provided that there is enough space. The sensor is mounted on a scan piezo tube which has five electrodes: four quadrants are used for scanning, the fifth electrode is used for dithering the cantilever by means of a digital Phase Lock Loop (PLL) with 5mHz frequency resolution. We employed a fibre interferometer deflection measurement for our LT-MFM. A special alignment holder is designed for this purpose. A 225 μ m length MFM cantilever is placed on an Alignment-Free AFM Cantilever holder chip from NanoSensors. Our design can sustain cantilever-fiber alignment down to 300mK without any signal loss. An improved fiber interferometer with $\sim 1 \times 10^{-3}$ A/ $\sqrt{\text{Hz}}$ noise level is designed and used to detect cantilever deflection. LT-MFM also enables us to work under high external magnetic fields.

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