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An ultra-low temperature scanning Hall probe microscope (SHPM) for magnetic imaging below 40 mK OZGUR KARCI, NanoMagnetics Instruments Ltd., JULIAN PIATEK, PAU JORBA, Laboratory for Quantum Magnetism, Ecole Polytechnique Federale de Lausanne (EPFL), MUNIR DEDE, NanoMagnetics Instruments Ltd., HENRIK RONNOW, Laboratory for Quantum Magnetism, Ecole Polytechnique Federale de Lausanne (EPFL), AHMET ORAL, Middle East Tech Univ, NANOMAGNETICS INSTRUMENTS LTD. TEAM, LABORATORY FOR QUANTUM MAGNETISM, ECOLE POLYTECHNIQUE FEDERALE DE LAUSANNE (EPFL) TEAM, MIDDLE EAST TECH UNIV TEAM
— We describe the design of a low temperature scanning Hall probe microscope (SHPM) for a dilution refrigerator system. A detachable SHPM head with 25.4 mm OD and 200 mm length is integrated at the end of the mixing chamber base plate of the dilution refrigerator insert (Oxford Instruments, Kelvinox MX−400) by means of a dedicated docking station. It is also possible to use this detachable SHPM head with a variable temperature insert (VTI) for 2 K–300 K operations. A microfabricated 1μm size Hall sensor (GaAs/AlGaAs) with integrated scanning tunneling microscopy (STM) tip was used for magnetic imaging. The field sensitivity of the Hall sensor was better than 1 mG/$\sqrt{}$Hz at 1 kHz bandwidth at 4 K. Both the domain structure and topography of LiHoF4, which is a transverse-field Ising model ferromagnet which orders below TC=1.53 K, was imaged simultaneously below 40 mK.

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