CONTROL ID: 2484290

ABSTRACT FINAL ID: 2EPo2C-02 [113]

TITLE: Non-destructive evaluation using a high-T_c SQUID microscope

AUTHORS (FIRST NAME, LAST NAME): Michael I. Faley[1], E. A. Kostyurina[2], P. Diehle[3], U. Poppe[4], A. Kovacs[1], Yu. V. Maslennikov[5], Valery P. Koshelets[5], Rafal E. Dunin-Borkowski[1]

INSTITUTIONS:
1. PGI-5 (Microstructure research), Forschungszentrum Juelich GmbH, Juelich, Germany.
2. The Moscow Institute of Physics and Technology , Dolgoprudny, Russian Federation.
3. RWTH Aachen University, Aachen, Germany.
4. CEOS GmbH, Heidelberg, Germany.
5. The Kotel'nikov Institute of Radio Engineering & Electronics RAS, Moscow, Russian Federation.

Abstract: We report the application of a scanning high-T_c SQUID microscope with a ferromagnetic flux guide [1] for the non-destructive evaluation of lithographically patterned thin-film magnetic structures. A soft magnetic amorphous Vitrovac foil was used to guide the flux from the samples, which were held at room temperature, to the liquid-nitrogen-cooled SQUID-sensor and back. The flux guide passes through a hole in the 1 mm x 2.5 mm pick-up loop of the high-T_c SQUID sensor, thereby providing improved coupling of the magnetic flux from the object to the SQUID. In order to avoid the influence of the SQUID biasing magnetic field on the object under investigation, a modulation and feedback coil was coupled to the pick-up loop of the SQUID directly and beyond the ferromagnetic flux guide. In contrast to magnetic force microscopy, which has much better spatial resolution, a high-T_c SQUID microscope with an extremely soft magnetic flux antenna does not significantly disturb the sample magnetization during image recording. The sample is moved using a precision *x*-*y* scanning stage and a *z*-translation stage driven by micro-step stepper motors, providing a positional resolution of better than 1 µm. The SQUID microscope can be used to measure the spatial distribution of the *z*-component of the stray field above a specimen, allowing different magnetic domain structure distributions before and after demagnetization to be recognized. Such measurements can be used to investigate magnetic coupling through barriers or the influence of pinholes in magnetic tunnel junctions or other spintronics devices. The recorded magnetic field can also be compared with results obtained from the same specimens using off-axis electron holography in the transmission electron microscope. Inhomogeneities in conductivity in non-magnetic bulk samples could be investigated with an eddy-current technique using a miniature double-D coil for excitation of eddy currents in the samples.

[1] U. Poppe *et al.,* Supercond. Sci. Technol., vol.17, 191 (2004).