

YBa²Cu³O⁷ and Nb NanoSQUIDs for the Investigation of Magnetization Reversal of Individual Magnetic Nanoparticles

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Abstract— We report on the fabrication, performance and application of sensitive YBa²Cu³O⁷ (YBCO) and Nb nanoSQUIDs to magnetization reversal measurements of individual magnetic nanoparticles. The YBCO SQUIDs are based on grain boundary Josephson junctions and are patterned in a single layer of epitaxially grown YBCO films by Ga focused ion beam milling. The Nb SQUIDs contain sandwich-type Josephson junctions with normal conducting HfTi barriers; they are fabricated with a multilayer technology that includes patterning by e-beam lithography and a combination of milling techniques and chemical-mechanical polishing. Due to the small inductance of the SQUID loops, ultralow white flux noise at 4.2 K can be achieved, which yields spin sensitivities of down to a few Bohr magnetons per unit bandwidth for a magnetic nanoparticle placed at 10 nm distance to the SQUID loop.

Keywords (Index Terms) — NanoSQUID; YBCO; Nb; focused ion beam milling; flux noise; magnetic nanoparticle.

IEEE-CSC & ESAS SUPERCONDUCTIVITY NEWS FORUM (global edition), September 2019.

Selected August 5, 2019. Reference STP649; invited presentation 1-SQ-I-8 given at ISEC, 28 July-1 August 2019, Riverside, USA.