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Flux noise in SQUIDs: Effects of deposited surface films[1] S.R. O'KELLEY, S.M. ANTON, J.S. BIRENBAUM, JOHN CLARKE, UC Berkeley, G.C. HILTON, H.-M. CHO, K.D. IRWIN, NIST Boulder, C.D. NUGROHO, A.F. DOVE, G.A. OLSON, Z.R. YOSCOVITS, V. ORLYANCHIK, D.J. VAN HARLINGEN, J.N. ECKSTEIN, University of Illinois at Urbana-Champaign — Magnetic flux noise in SQUIDs and superconducting qubits with a spectral density $S_\Phi(f)$ scaling as $1/(f/1Hz)^\alpha$ is understood to arise from the random reversal of spins localized at the surface of the superconducting film. We present experimental results showing the effects on $S_\Phi(f)$ of Au, SiNx, NbN, and Al2O3 films deposited on the upper surface of Nb and NbN dc SQUID loops. For each measurement, we fabricated six identical SQUIDs on a single chip and then capped the surface of either half or all the SQUID loops. Certain capping layers, such as Au, had no discernible effect on $S_\Phi(f)$ with regard to the magnitude, slope α, and temperature dependence. On the other hand, some capping layers significantly reduced $S_\Phi(1Hz)$—by a factor of about two in the case of SiNx. Furthermore, some layers significantly affected the value of α and the temperature dependence of both $S_\phi(1Hz)$ and α. These results further establish the importance of the role of the surface of the SQUID loop on its flux noise. We discuss implications for microscopic models of flux noise in light of these measurements.

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