77 K dc SQUID for Practical Applications

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Abstract

We have produced sensitive 77 K dc superconducting quantum interference device (SQUID) magnetometers and gradiometers for diverse applications. Their performance in terms of high energy sensitivity and low flux noise levels in both the $1/f$ and white noise regimes are comparable to commercial Nb junction technology. We have achieved $1/f$ noise reduction by a progressive improvement in the crystalline quality of the thin films. Our goal of $1/f$ noise on multilayer SQUID magnetometers and gradiometers is less than 10 fT / √Hz and 5 fT / √Hz for white noise. The clean and smooth step coverage and via areas are critical issues for low noise device fabrication. The estimation of inductance is important for optimizing effective area to reduce noise. Further reduction in 1 / f noise in HTS thin -film SQUIDs under various magnetic conditions (including static fields) may be achievable by the addition of pinning sites. This can be accomplished by the use of homo/heteroepitaxial buffer layers and appropriate processing techniques. If successful, we will be able to use SQUID magnetometers and gradiometers in many different applications such as MEG, MCG, geomagnetism, and nondestructive evaluations.