

A Low-noise Double Relaxation Oscillation SQUID Magnetometer for Measuring Magnetoencephalogram

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We developed a useful SQUID magnetometer for biomagnetic applications, magnetoencephalogram (MEG) and magnetocardiogram(MCG), etc. The SQUIDs are based on Double Relaxation Oscillation SQUID(DROS). DROS consists of two SQUIDs(signal SQUID and reference SQUID) in series, and a relaxation circuit of an inductor and a resistor. Specially we used single reference junction instead of the reference SQUID. The SQUIDs are based on hysteretic Nb/AlO_x/Nb junctions, fabricated by using a simple four level process. Because DROS magnetometer has large flux-to-voltage transfer coefficient, we can use simple flux-locked loop electronics for SQUID operation. When the DROS magnetometer was operated inside a magnetically shielded room, its average magnetic field noise was about $3 \text{ fT}/\sqrt{\text{Hz}}$ at 100 Hz. This noise level is low enough to measure biomagnetic fields. In this paper, we describe noise characteristics of DROS magnetometer, depending on the operation condition.

Key word : SQUID, DROS, MEG