YBCO Step-edge Junction dc SQUID Magnetometers with Multi-loop Pickup Coil on Sapphire Substrates

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Step-edge Josephson junctions and direct coupled SQUID magnetometers on sapphire substrates have been fabricated with *in situ* deposited films of CeO_2 buffer layer and $YBa_2Cu_3O_7$ films on the low angle steps formed on 1 cm x 1 cm *r*-plane sapphire substrates. Typical 5- m-wide Josephson junctions have R_N of 3 and I_C of 50 A at 77 K. The direct coupled SQUID magnetometers were designed to have pickup coils of 50- m-wide 16 parallel loops on the 1 cm x 1 cm substrates with outer dimension of 8.8 cm x 8.8 cm. The SEJ SQUID magnetometers exhibit relatively low $1/f$ noise even with dc bias control, and could be stably controlled by flux-locked-loop in the magnetically disturbed environment. Field noise of the dc SQUID was measured 200 300 fT/ Hz in white noise region, and about 2 pT/ Hz at 1 Hz measured with dc bias method.