

Observation of rf SQUID characteristics in YBCO bulk at 77 K

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MS received 17 July 1990

Abstract. RF SQUID behaviour due to grain boundary weak links in a bulk YBCO is observed at 77 K using modified commercial rf electronics. Porous samples with low I_c are found to show this characteristic whereas dense samples with higher I_c do not show SQUID behaviour. V - B modulation characteristic is found to be better when the rf pumping frequency is kept slightly higher than the resonance frequency of the tank circuit. Designing of coil for tank circuit with appropriate Q has been found to be very crucial for seeing the SQUID behaviour. Estimation of parameters such as coupling constant, mutual inductance, inductance and radius of the SQUID loop, have been made and their significance is discussed. Flux noise spectrum of the bulk rf SQUID in flux locked mode is also reported.

Keywords. High T_c superconductors; rf SQUIDs; granular superconductors.

PACS No. 74.70

1. Introduction

High T_c oxide superconductors are granular in nature and superconducting grains are weakly connected at the grain boundary. These grain boundary weak links work as Josephson junctions (Gupta *et al* 1987). The possibility of using these grain boundary weak links in a ring of a bulk superconductor to fabricate an rf SQUID was realized during first measurement of flux quantum (Gough *et al* 1987; Colclough *et al* 1987). It was later demonstrated that even the superconducting loops between grains could give rise to rf SQUID behaviour in high T_c bulk samples (Pegrum *et al* 1987; Tichy *et al* 1988). In this paper we report the observation of rf SQUID behaviour at 77 K in YBCO bulk superconductor. The effect of Q of the tank coil and quality of the sample on rf SQUID behaviour are discussed. An estimate of various SQUID parameters has been made which provides insight into the observed rf SQUID behaviour.

2. Experimental

YBCO samples are prepared by the standard solid state reaction technique using Y_2O_3 , $BaCO_3$ and CuO of 99.9% purity. Different quality of pellets has been prepared by varying the pelletizing pressures before sintering. For realizing the rf SQUID behaviour in bulk YBCO, a rectangular shaped sample is cut from the superconducting YBCO pellet. Commercial rf SQUID electronics used for conventional niobium rf