Characteristics of High－Tc Superconducting Quantum Interference Devices Fabricated by Using Scanning Probe Microscope

黃威嘉、王立民

E-mail: 9806459@mail.dyu.edu.tw

ABSTRACT

Superconducting quantum interference devices (SQUIDs) were fabricated by inducing a selective surface modification on YBa2Cu3O7-y (YBCO) microbridges with an atomic force microscope lithography (AFML) attached in a scanning probe microscopy (SPM) system. The surface modification was probated in the electric field of conductive AFM tip and created oxide protrusions across the entire strips as the tunneling barriers High-Tc superconducting YBCO thin films were grown on SrTiO3 (STO) substrates by using rf magnetron sputtering. The photolithography and ion etching techniques were used to fabricate the thin film for SQUID pattern with 3- μm-width mircobridges. The crystalline orientation and the surface morphology were characterized by the X-ray diffraction (XRD) and the AFM, respectively.

The surface modification can be controlled by tuning the applied bias voltage and scan speed with threshold values of 5 V and 0.1 μm/sec. The protrusion height is increased with an increase of bias voltage or a decrease of scan speed. The temperature dependent of resistance for the fabricated SQUID reveals a resistive broadening as temperatures near Tc, showing a superconducting-tunneling-like behavior.

Keywords : High-Tc YBCO、Scanning Probe Microscropy、Atomic force microscope lithography、Superconducting quantum interference devices

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