

# Fabrication of Nano SQUID in multilayered thin film of Y123/P123 using Focused Ion Beam

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The *a*-axis oriented multi layered thin films of YBa<sub>2</sub>Cu<sub>3</sub>O<sub>7</sub> and *c*-axis oriented PrBa<sub>2</sub>Cu<sub>3</sub>O<sub>7</sub> were grown alternately on SrLaGaO<sub>4</sub> (100) substrate using pulsed laser deposition. The resistance vs temperature (*R-T*) characteristics show transition temperature of 71 K with the transition width ( $\Delta T_c$ ) of 4 K for multilayered thin film (Fig. 1). We have fabricated a nano superconducting quantum interface device (nano-SQUID) with the effective area of 150 nm X 100 nm using three dimensional focused ion beam (3-D FIB) etching process (Fig. 2 (a)). The value of  $\Delta T_c$  for SQUID is found higher than the multilayered thin film which can be the effect of ion irradiation during the fabrication process. The critical current of 0.11 mA is appeared in current-voltage (*I-V*) characteristics of SQUID at 20 K. The nano SQUID shows suppression in critical current and voltage step in current voltage characteristics. These voltage steps belong to the applied radio frequency wave power and frequency (Fig. 2 (b)).

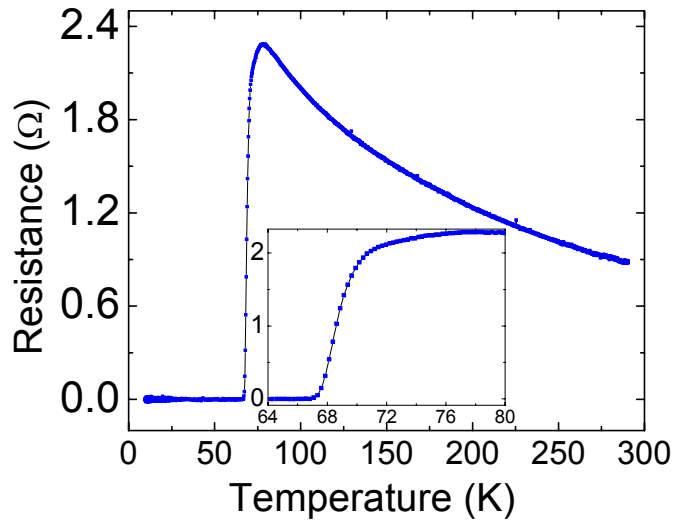


Fig. 1:  $R$ - $T$  characteristics of multilayered thin film of Y123/P123 show a transition temperature ON at 71 K with the transition width of 4 K. Inset shows the magnified region near transition temperature.

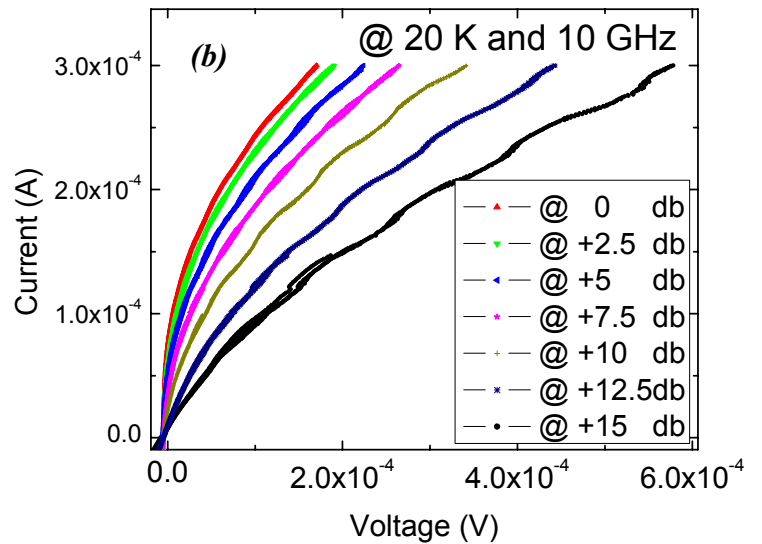
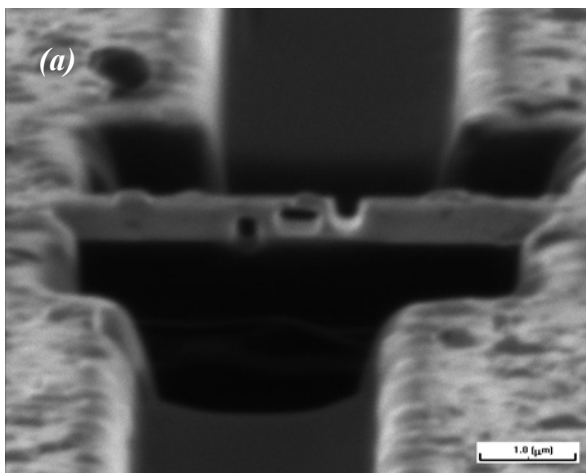


Fig. 2: (a) FIB image of the nano-SQUID fabricated on multilayered thin film of Y123/P123. (b)  $I$ - $V$  characteristics of Nano-SQUID fabricated on multilayered thin film of Y123/P123 at different power of applied rf wave frequency 10 GHz at 20 K. The voltage steps are become clear as we increase the power of rf wave from 0 db to +15 bd.