Fabrication of Ultra Sensitive Cantilevers with Nb Superconducting Annulus Thin Film

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We have studied the fabrication of ultra sensitive silicon cantilevers with Nb superconducting annulus thin film. The cantilevers were beam shape, which was 400um long, 4um wide, and 0.34um thick, with a 20um-wide reflector for fiber optic interferometer and a 30-um-wide paddle for mounting a Nb annulus. Cantilevers with spring constants 1.05×10^{-4} N/m were fabricated, with resonance frequency 1366 Hz and quality factor 220 which were obtained at room temperature in ~ 10^{5} Torr vacuum to avoid air damping. Nb annulus thin films were fabricated onto the paddle of the cantilever by electron beam lithography, DC magnetron sputtering, and lift-off. For a 50nm-thick Nb annulus with the inner and outer radii of 5um and 10um, the superconducting properties were studied including the superconducting transition temperature ($T_{c,offset}$), 7.3K. More details will be discussed.

Keywords: cantilever, Nb, superconductor, thin film