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Ultra-thin superconducting film coated silicon nitride nanowire resonators for low-temperature applications ABHILASH SEBASTIAN, NIKOLAY ZHELEV, ROBERTO DE ALBA, JEEVAK PARPIA, Cornell University — We demonstrate fabrication of high stress silicon nitride nanowire resonators with a thickness and width of less than 50 nm intended to be used as probes for the study of superfluid ^{3}He. The resonators are fabricated as doubly-clamped wires/beams using a combination of electron-beam lithography and wet/dry etching techniques. We demonstrate the ability to suspend (over a trench of depth ˜8 m) wires with a cross section as small as 30 nm, covered with a 20 nm superconducting film, and having lengths up to 50 m. Room temperature resonance measurements were carried out by driving the devices using a piezo stage and detecting the motion using an optical interferometer. The results show that metalizing nano-mechanical resonators not only affects their resonant frequencies but significantly reduce their quality factor (Q). The devices are parametrically pumped by modulating the system at twice its fundamental resonant frequency, which results in observed amplification of the signal. The wires show self-oscillation with increasing modulation strength. The fabricated nanowire resonators are intended to be immersed in the superfluid ^{3}He. By tracking the resonant frequency and the Q of the various modes of the wire versus temperature, we aim to probe the superfluid gap structure.

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