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Design and Fabrication of High Q Titanium Nitride Resonators

DAVID WISBEY, JIANSONG GAO, MICHAEL VISSERS, JEFFREY KLINE, MARTIN WEIDES, DAVID PAPPAS, National Institute of Standards and Technology — Titanium nitride (TiN) is a new material that shows promise in quantum information circuits as a low loss material for resonators, and as a multiplexed kinetic inductance photon detector. We have measured lumped element LC resonators and coplanar waveguides resonators. For the lumped element resonator we report internal quality factor (Q_i) of over 300,000 at low power, in the single photon regime, and 4 million at high power, and for a half wave coplanar waveguide we report low power Q_i of 800,000 and high power Q_i of 5 million. We found that overetch in single layer devices can shift the resonance frequency and affect the internal quality factor Q_i , and that as the trench depth grew, both the resonance frequency and internal quality factor increased. When designing resonators it is important to know quantities such as the kinetic inductance, superconducting transition temperature (T_c), penetration depth, and amount of overetch so the resonator can be accurately simulated.

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