Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Low Loss Superconducting Titanium Nitride Coplanar Waveguide Resonators MICHAEL VISSERS, DAVID WISBEY, JIANSONG GAO, JEFFREY KLINE, MARTIN WEIDES, DAVID PAPPAS, NIST-Boulder — The introduction of new, low loss superconducting materials will be necessary for the improvement of superconducting qubits. To fulfill this aim, thin films of titanium nitride (TiN) were sputter-deposited onto intrinsic Si and c-plane sapphire wafers with and without SiN buffer layers. The films were then fabricated into RF coplanar waveguide resonators, and internal quality factor measurements were taken at millikelvin temperatures in both the high and low power limits, i.e. many and single photon regimes, respectively. At high power, internal quality factors (Qi's) higher than 10^7 were measured for multiple TiN films with a predominantly (200) orientation. Films that showed significant (111) texture invariably had much lower Qi's in this regime, on the order of 10^5. Our studies show that the (200) TiN is favored for growth at high temperature on either bare Si or substrates with SiN buffer layers. However, growth on bare sapphire or Si (100) at low temperature resulted in primarily a (111) orientation. Ellipsometry and Auger measurements indicate that the (200) TiN growth on the bare Si substrates is correlated with the formation of a thin, $\sim$2nm, layer of SiN during the pre-deposition procedure. We found that TiN grown on these surfaces also showed significant increases of Qi in the low power limit, while thicker SiN buffer layers resulted in reduced Qi's.

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Date submitted: 28 Nov 2010 Electronic form version 1.4