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TiN superconducting coplanar waveguide resonators with single-photon quality factors of 1.5 million GREG CALUSINE, DANNA ROSENBERG, DAVID HOVER, RABINDRA DAS, ALEXANDER MELVILLE, XHOVALIN MILOSHI, WAYNE WOODS, JONILYN YODER, MIT Lincoln Laboratory, WILLIAM OLIVER, MIT Lincoln Laboratory; Research Laboratory of Electronics, MIT — The investigation of loss mechanisms in superconducting coplanar waveguide (CPW) resonator provides an efficient means to elucidate relevant loss mechanisms affecting superconducting qubit circuits. As compared to superconducting qubits, the reduced complexity of CPW fabrication coupled with the straightforward characterization of CPW properties facilitates the deconvolution of the impact of individual fabrication steps on the CPW performance. We assess this impact by characterizing the statistically significant differences in internal quality factors (Q_i) at the single-photon level resulting from different fabrication processes in aluminum and titanium nitride (TiN) superconducting thin film CPW resonators on silicon. We demonstrate repeatable Qi's at the single-photon level of approximately $1.5\text{x}10^6$ in TiN CPW resonators with 90 percent of devices showing Q_i's above $1\text{x}10^6$ and single Q_i's as high as $3.8\text{x}10^6$. This work is sponsored in part by the Laboratory for Physical Science, IARPA, and the Assistant Secretary of Defense for Research and Engineering under Air Force Contract FA8721-05-0002. Opinions, interpretations, conclusions, and recommendations are those of the authors and are not necessarily endorsed by the United States Government.

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