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Characterization of the dominant loss mechanisms in superconducting coplanar waveguide resonators GREG CALUSINE, ALEXANDER MELVILLE, WAYNE WOODS, DAVID K. KIM, XHOVALIN MILOSHI, ARJAN SEVI, JONILYN YODER, MIT Lincoln Laboratory, WILLIAM D. OLIVER, MIT Lincoln Laboratory; Research Laboratory of Electronics, MIT — The characterization of losses in superconducting coplanar waveguide (CPW) resonators is commonly used as a surrogate means to probe relaxation in superconducting qubit capacitor structures. However, this method is complicated by device-to-device variations that result from a sensitivity to variations in fabrication processes, packaging, and measurement methods. We present results on characterizing ensembles of aluminum, niobium, and titanium nitride superconducting CPW resonators to determine the statistical significance of the effects of fabrication process changes on resonator intrinsic quality factor. Furthermore, we report progress on experiments aimed at determining the impact of other competing loss mechanisms such as vortex trapping, package coupling, and substrate loss. These results are then applied to the study of relaxation in superconducting qubits and investigations into the microscopic origins of surface losses. This research was funded in part by the Intelligence Advanced Research Projects Activity (IARPA). The views and conclusions contained herein are those of the authors and should not be interpreted as necessarily representing the official policies or endorsements, either expressed or implied, of IARPA or the US Government.

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