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Characterization of coplanar waveguide resonators made of nitride superconductors[1] HIROTAKA TERAI, National Institute of Information and Communications Technology, TOKYO UNIVERSITY COLLABORATION — Superconducting coplanar waveguide (CPW) resonator is a key component of superconducting electromagnetic field detectors and superconducting qubits based on circuit quantum electrodynamics (QED), where a high quality factor is desirable for applications. We have previously reported superconducting transmon qubits based on fullyepitaxial NbN/AlN/NbN tunnel junctions grown on a MgO substrate. However, the internal quality factor of the superconducting CPW resonator made of a (100) NbN film were at most several thousands, suggesting the existence of a loss mechanism coming from the MgO substrate or the interfacial two-level-systems (TLS). To clarify the origin of the loss mechanisms in superconducting CPW resonators, we systematically investigated the dependences on substrate materials, deposition conditions of nitride superconductors, and surface treatment conditions prior to the deposition. CPW resonators made of NbN or TiN deposited on a hydrogenterminated silicon substrate without any surface treatment showed a high internal quality factor above one million at the microwave power of a single photon level. Our results support that loss in superconducting resonators is dominated by TLS at the interface between the superconductor and the substrate.

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