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Fabrication and characterization of transmon qubits and rectangular waveguide resonators for circuit quantum electrodynamics DONG-GWANG HA, JUNG HWAN PARK, SO-YEON JUN, WOON SONG, YONUK CHONG, Korea Research Institute of Standards and Science, Daejeon 305-340, Korea — We present our design, fabrication and characterization of superconducting transmon qubits and resonators for circuit quantum electrodynamics (QED). We have made coplanar waveguide resonators and rectangular waveguide resonators. The characteristics of the resonators are well controlled by the design parameters, with the fundamental frequencies in the range of 1 to 8 GHz and the quality factors in the range of 10^2 to 10^6, respectively. We measured the resonator characteristics as a function of temperature. The excitation power dependence of the resonator characteristics was also investigated. For transmon qubits, we fabricated 100 nm-scale $Al/Al_2O_x/Al$ tunnel junctions with e-beam lithography and double angle evaporation. The junctions were characterized at low temperature down to 10 mK. Furthermore, quantum state measurement and manipulation in circuit QED structure will be discussed.

Dong-Gwang Ha
Korea Research Institute of Standards and Science, Daejeon 305-340, Korea

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