22

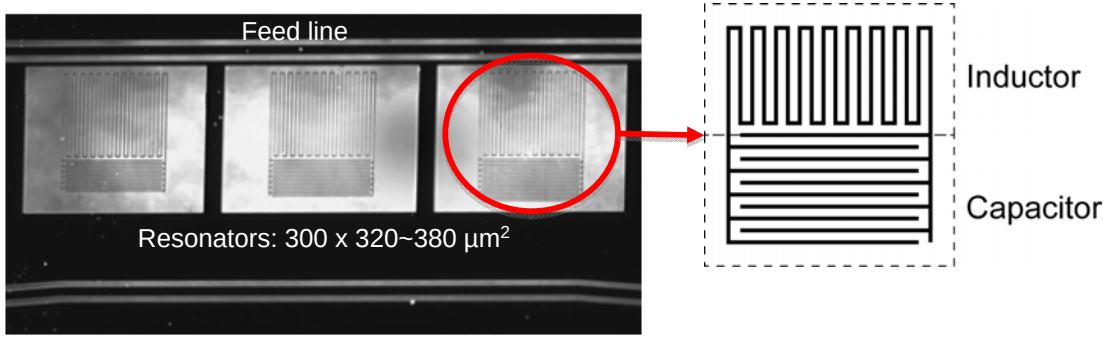
Thin film evaluations by means of superconducting resonator

- Reveal of microwave properties of thin films due to superconductivity -

NTT

Motivation

Lumped element superconducting resonators have a large Q (~10^6) value and its resonant frequency, resonant peak shape, and phase circle are quite sensitive to the changes of inductance and/or capacitance. Using this sensitivities, dielectric thin films can be evaluated.



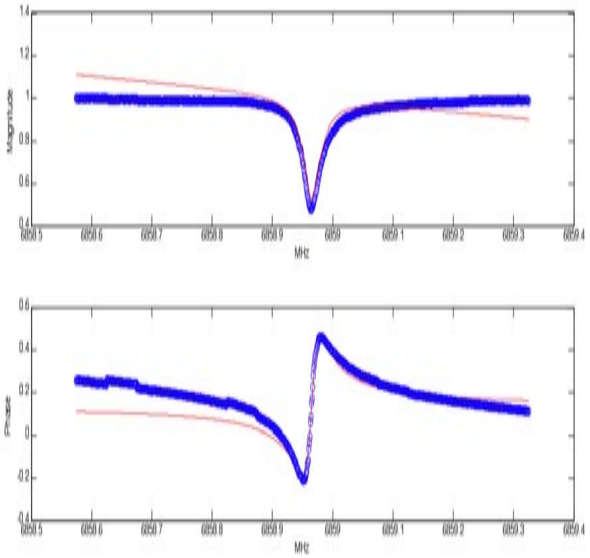
Niobium superconducting resonators with a transmission line.

Originality

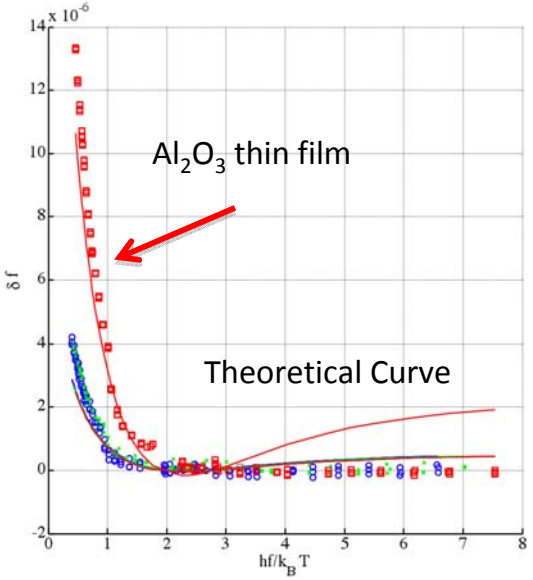
The dielectric constant of ALD thin films deposited onto the lumped element superconducting resonator can be evaluated by this method. At low temperature, ALD thin films deviate from the two-level fluctuation (TLF) somehow.

Impact

This method gives us the simple evaluation of electrical properties of thin films at microwave frequencies and the estimation of fundamental properties for superconducting qubit circuits.



The amplitude and the phase at resonant frequency.



The resonant frequency shift at various normalized temperatures.

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