Contribution ID: **357** Type: **Poster**

RF Loss Tangent and Two-Level-System Noise of Amorphous Silicon and Crystalline Silicon Dielectrics for Sub/mm Astronomy Applications

Thursday, 25 July 2019 18:45 (15 minutes)

Superconducting sensors for millimeter and submillimeter astronomy require thin dielectric films. The dielectrics SiO2 and SiNx are currently used for these applications for fabrication convenience reasons. However, they have a loss tangent (tan δ) close to 1e-3. The loss tangent is a critical parameter for these applications because it determines the microstripline's attenuation and the spectral resolution of superconducting spectrometers. The TLS noise of such high-loss dielectrics is too high for them to be incorporated into parallel-plate capacitors (PPCs) for KIDs. Lower loss dielectrics are thus highly desirable, with a loss tangent of 1e-4 or less. To achieve this goal, two low-loss dielectrics are being investigated, crystalline silicon (cSi) and hydrogenated amorphous silicon (a-Si:H). We are undertaking a systematic survey of loss tangent and TLS noise for a-Si:H, virgin c-Si, and wafer-bonded c-Si at both ~1-2 GHz and 100-400 GHz, and here we report on the RF measurements. We fabricated niobium LC resonators with PPCs, incorporating the various dielectrics in the PPC structure. By analyzing the resonance frequency of these resonators at different temperatures (between 250 mK and 400 mK), and for different readout powers, it is possible to deduce the low-power loss tangent, the loss tangent at high readout powers, and the TLS noise of these dielectrics. We present measurements of loss tangent and TLS noise for films with different thicknesses, compare a-Si:H and c-Si, and measure the impact of wafer-bonding. Future work will correlate these results with 100-400 GHz measurements. This study contributes to the development of new low-loss dielectrics in future superconducting sensors for millimeter and submillimeter astronomy, and is expected to provide significant improvements in terms of sensitivity and design architecture possibilities.

Less than 5 years of experience since completion of Ph.D

N

Student (Ph.D., M.Sc. or B.Sc.)

N

Primary authors: Prof. GOLWALA, Sunil (California Institute of Technology); Dr DEFRANCE, Fabien (California Institute of Technology); Dr BEYER, Andrew (Jet Propulsion Laboratory); Dr SAYERS, Jack (California Institute of Technology); Dr DATTA, Debopam (California Institute of Technology)

Presenter: Prof. GOLWALA, Sunil (California Institute of Technology)

Session Classification: Poster session

Track Classification: Low Temperature Detector Development and Physics