

Advanced Capacitor fabrication for THz heterodyne receivers

Background: Heterodyne receivers offer the ultimate resolution and frequency resolution for radio-astronomy observation. Modern receivers operate at cryogenic temperatures (typically 4K) for their detectors to take advantage full advantage of their superconducting properties. This in turns means that the whole detector system, including the first part of the IF chain, need to operate at 4 K. For this purpose, it is crucial to be able to predict with high accuracy the performances at cryogenic temperatures of all components in the detector.

Unfortunately, the performance of the different electrical components are seldom guaranteed by manufacturers for operation at 4 K and consequently the deviation between the room temperature and 4K performance of the actual components makes the optimization of receivers a cumbersome process. In addition, using commercial components imply also some constrains of the detector designs due to the fixed size and shape of the components.

Thesis project: With this thesis, we propose for a student to particularly focus at the microfabrication and 4K performance evaluation of one type of components: single-layer capacitors. The thesis project includes the design, fabrication and characterisation of capacitors that are relevant both in terms of capacitance and shape for further integration in the IF chain of THz receivers.

The master thesis is divided into four different stages:

- Literature survey
- Component design and microfabrication
- Microwave Characterization at 4 Kelvin

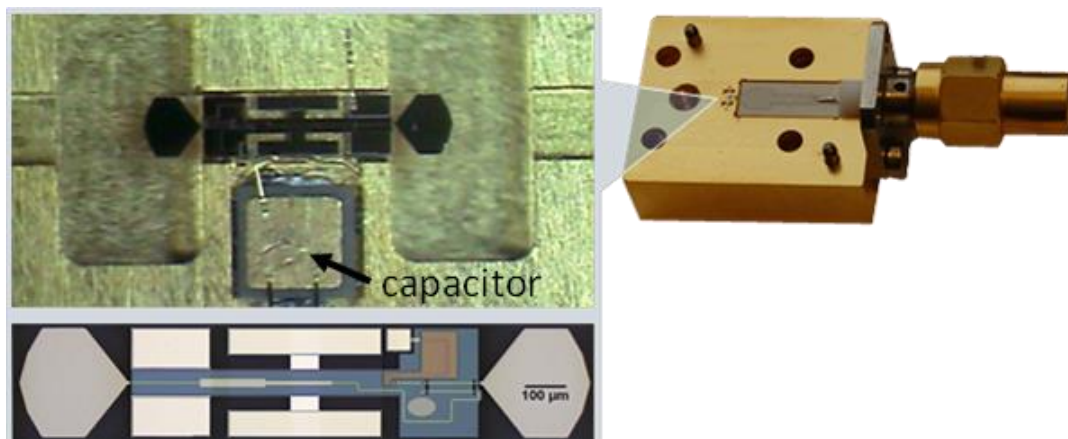


Figure 1 ALMA band 5 mixer with IF capacitor

Prerequisites

Course in Electromagnetics

Interest and/or courses in microfabrication techniques.

Course in Superconductivity, low temperature physics, or THz electronics are not required, but good to have

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