Design and fabrication of the KID-based light detectors of CALDER

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The goal of the CALDER (Cryogenic wide-Area Light Detectors with Excellent Resolution) project is the development of light detectors with large active area and noise energy resolution smaller than 20 eV RMS using phonon-mediated Kinetic Inductance Detectors (KIDs). The detectors are developed to improve the background suppression

in large-mass bolometric experiments such as CUORE, via the double read-out of the light and the heat released by particles interacting in the bolometers.

In this work we present the fabrication process, starting from the silicon wafer arriving to the single chip. In the first part of the project we designed and fabricated KID detectors using aluminum. Detectors are designed by means of state-of-art software for electromagnetic analysis (SONNET). The Al thin films (40 nm) are evaporated on high quality, high resistivity (>10 kohm*cm) Si(100) substrates using an electron beam evaporator in a HV chamber. Detectors are made in direct-write mode, using Electron Beam Lithography (EBL), positive tone resist poly-methyl methacrylate (PMMA) and lift off process. Finally the chip is diced into 20x20 mm2 chip and assembled in a oxigen free copper (OFC) holder using PTFE support.

To increase the energy resolution of our detectors we are changing the superconductor to sub-stoichiometric TiN and/or multilayer Ti-TiN, both deposited by means of DC magnetron sputtering. For this kind of materials a new fabrication method is being developed.