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Development of microwave superconducting microresonators for neutrino mass measurement in the HOLMES framework

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The European Research Council has recently funded HOLMES, a project with the aim of performing a calorimetric measurement of the electron neutrino mass measuring the energy released in the electron capture decay of 163Ho. The baseline for HOLMES are microcalorimeters coupled to a Transition Edge Sensor (TES) read out with a rf-SQUID, for microwave multiplexing purposes. A promising alternative solution is based on superconducting microwave resonators, that have undergone rapid development in the last decade. This detectors, called MKIDs (Microwave Kinetic Inductance Detectors), are inherently multiplexed in the frequency domain and suitable for even larger-scale pixels

array, with theoretical higher energy resolution and faster response. The aim of our activity is to develop arrays of microresonator detectors for X-rays spectroscopy and suitable for the calorimetric measurement of the energy spectra of 163Ho. Superconductive multilayer films composed by a sequence of pure Titanium and stoichiometric TiN layers show many ideal properties for MKIDs, such as low loss, large sheet resistance, large kinetic inductance, and tunable TC. We developed Ti/TiN multilayer microresonators with reproducible critical temperature TC within the range from 70 mK to 4.5 K and with good uniformity. In this contribution we present the design solutions adopted, the fabrication processes, the developed readout set-up and the characterization results obtained with X-ray sources.