Experimental study of a Josephson junction based thermometer and its possible application in bolometry

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We characterise an Al/AlOx/Ti/AlOx /Al (SIS'IS) structure in terms of its zero bias slope. It shows a large temperature dependence ($\partial R_0/\partial T \sim 10^7\ \Omega$/K) close to the titanium superconducting transition. Sensitivity is measured to be 2 μK/$\sqrt{\text{Hz}}$ rising of heterodyne measurement. Because of the low dissipation in the supercurrent branch, we discuss the structure as a bolometer. We analyse noise and dissipation in this system, allowing us to estimate the figures of merit. The electrical Noise Equivalent Power, limited by the amplifier noise, is calculated to be around 2.10^{-16} W/$\sqrt{\text{Hz}}$. This is more than 20 times higher than the thermodynamic noise limit, leaving some room for improvement. The short relaxation time $\tau_{\text{e-ph}} \sim 1.6\ \mu$s would allow faster operation than in the currently available Ti-Transition Edge Sensor. Furthermore, the tunnel junctions allow to overcome the size limitation imposed by the proximity effect present in traditional transition edge sensors, without sacrificing the sensitivity, making the SIS'IS structure a candidate for bolometry.