Vacuum measurements of a novel micro-resonator based on tin whiskers performed at mK temperatures

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The spatial dimensions of traditional mechanical resonators used in the research of superfluid ^{3}He-B (e.g. vibrating wires/grids, quartz tuning forks, etc.) are usually much larger than the coherent length ξ, and this leads to a suppression of the energy gap near the surface of such resonators. As a consequence, the value of critical velocity v_{c} is lowered to 1/3 of the theoretical value for the Landau critical velocity v_{L}. Due to the excitations trapped near the resonator surface, the sensitivity of these devices is severely affected at ultra low temperatures, where the density of the volume excitations exponentially falls down. In order to increase resonators sensitivity at ultra low temperatures, one have to shorten their geometrical characteristics. There are several technological methods available to manufacture mechanical nano-resonators, however their quality factors Q is usually lower than those of classical mechanical resonators. We present a method of preparation and preliminary vacuum measurements conducted at $\sim 20\,\mathrm{mK}$ of a new type of micro-resonator based on tin-whiskers. Tin whiskers have $\sim 1\ \mu$m radius and their length can be $\sim 1-2$ mm. As added benefit, the tin whiskers are monocrystalline metal fibers with relatively smooth surface and being superconducting at low temperatures one may expect their high Q-factors.

Section: DV - Devices

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