The Mechanism of Acoustic Dissipation of an Oscillating Quartz Tuning Fork Immersed in He II

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The dissipative processes due to viscous friction and acoustic radiation from vibrating tuning fork prongs, in the hydrodynamic and ballistic regimes of the scattering of thermal excitations, are investigated by measuring current - voltage characteristics of a quartz tuning fork immersed in He II. The vibrating tuning forks with different resonant frequency (32, 37, 77 and 97 kHz) were used and measurements were carried out at saturated vapor pressure in temperatures range 0.35 K - 1.5 K. It was found that at $T \geq 1$ K for the hydrodynamic flow regime in He II, the main dissipative process is the viscous friction, and acoustic dissipation mechanism is significant only at frequencies above 70 kHz. At $T \leq 0.5$ K, for the ballistic regime, the scattering mechanism of the dissipation due to scattering of thermal excitations by vibrating tuning fork prongs predominates only for tuning forks with low frequency (32 kHz) and acoustic dissipation mechanism dominants in almost the entire frequency range.