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Radio-frequency tunnel-junction shot noise thermometry and its application to the study of thermal properties at low temperature JUNG HWAN PARK, DONG-GWANG HA, WOON SONG, YONUK CHONG, Korea Research Institute of Standards and Science, Daejeon 305-340 — We developed a radio-frequency broadband measurement setup for shot noise thermometry in the temperature range from 0.1 K to 300 K. The noise power from a metallic tunnel junction was measured at 1 GHz with a bandwidth of 400 MHz. Very small noise signal from the tunnel junction was amplified by a cryogenic HEMT amplifier. The signal was then amplified by a room temperature amplifiers followed by a diode detector that converts the noise power into voltage output. Broadband measurement technique enables a fast measurement of RF signal. The shot noise thermometer directly measures the electron temperature and our measurement uncertainty is less than 3% in the sub-Kelvin range. Because of the small size of the tunnel junction, local measurement of the temperature on a device is possible. Since we measure the electron temperature directly, we can apply this technique to the study of thermal properties at low temperature. We suggest a method of measuring electron temperature before and after a thermal process in a chip at low temperature, which will help understanding of the thermal properties of electron-phonon system at low temperature.

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