Resistive Behaviorsof a superconductingNbNhot electron bolometer in a magnetic field

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We report on the detailed study of resistive behaviors of an NbN superconductinghot electron bolometer (HEB) in a perpendicular magnetic field. The superconducting HEB device consists of an NbN thin-film microbridge measuring 0.2-mm long, 2.0-mmwide and 5.5-nm thickand a twin slot antenna for coupling THz radiation. We have measured the resistance-temperature and current-voltage characteristics of the superconducting HEB deviceby changing the applied magnetic fields. It isclearly observedthat the external magnetic fieldenhances the thermally activated flux flowleadingto the broadening of theresistance-temperature transition. The external magnetic field also enhances the density of free vortices and the flux flow resistance is therefore increased significantly.From the measured current-voltage characteristics of the superconducting HEB device, we find that the flux flow resistanceis nearly linearly proportional to the magnetic fieldat low vortex velocities.At high vortex velocities, instability appears in the measured current-voltage characteristicsof the superconducting HEB device. We attribute this instabilityto the nonlinear flux-flow behavioraccording tothe Larkin and Ovchinnikov theory. In terms ofthe dependence of the instability upon the applied magnetic field, we have extracted the inelastic scattering time and the diffusion length of quasiparticles. The magnetic field dependency of the direct detection characteristics of the superconducting NbN HEB at 4 K has also been studied. Detailed experimental results and analysis will be presented.