FINE SPECTRAL FEATURES IN TERAHERTZ WAVE EMITTING $Bi_2Sr_2CaCu_2O_{8+d}$ MESAS

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Josephson Junctions are the simplest voltage to high frequency converters which can be used as a solid state source of terahertz radiation. Since terahertz waves is an important tool across the physical, chemical and biological sciences, the search is continuing for reliable coherent, continuous, tunable and compact solid-state sources. Although Josephson junctions are potential candidate, the mechanism of powerful terahertz emission from intrinsic Josephson junctions of layered high temperature superconductor $Bi_2Sr_2CaCu_2O_{8+d}$ (Bi2212) mesas is still unresolved. It is shown that the emission frequency is related to mesa width which implies cavity resonance. On the other hand, how synchronization establishes between layers has to be determined. Large area mesas ranging from 100x300 to 40x300 um^2 with various heights were formed on Bi2212. Current-voltage (I-V) and THz emission characteristics were obtained at various temperatures. Detailed examination of I-V curves indicated that there are messenger bumps in return branch just before the THz emission. These spectral features are more robust in low frequency mesas. Furthermore, the spectral features in I-V curves were investigated to find a correlation between emission frequency and feature energy. Recent THz experiments on mesas with various geometries and fabrication techniques will also be discussed.

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