Non-Collective Pinning of Josephson Vortices in Stacked Intrinsic Josephson Junctions

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Intrinsic Josephson junctions formed in Bi2Sr2CaCuO8+δä (Bi-2212) single crystals provide a useful platform to study Josephson vortex dynamics, which is incorporated with the c-axis transport measurements. We fabricated a small mesa structure of Bi-2212, which is isolated from a basal part, and obtained currnt-voltage (I-V) characteristic curves along the c-axis. Applied with the parallel magnetic field to the ab-plane, Josephson vortex flow branches (JVFBs) appear in the I-V curve as a result of dissipative motion of Josephson vortices (JVs) in a stack, while the quasiparticle tunneling branches are weakened. We investigated the JVFBs in detail with varying the strength and the application angle of magnetic field. Our experimental data indicate that the pinning/depinning process of JVs in the stack takes place in a noncollective way and the moving JVs form a triangular lattice structure with each other, resulting into a constant voltage difference between each JVFB and an additional large in-plane dissipation originated from JV lattice motion.