Vortex flow characteristics of Bi$_2$Sr$_2$CaCu$_2$O$_{8+\delta}$ Long Intrinsic Josephson Junctions

KAZUO KADOWAKI, KOHEI KAWAMATA, YUIMARU KUBO, KAZUKI FUKUI, TAKASHI YAMAMOTO, ITSUHiro KAKEYA, Institute of Materials Science, University of Tsukuba — Intrinsic Josephson junction characters in Bi$_2$Sr$_2$CaCu$_2$O$_{8+\delta}$, where the junction length $L$ is much longer than the Josephson length $\lambda_J=\gamma s$, have been studied from viewpoint of Josephson vortex dynamics, since they are expected to be released from the strong geometrical constraint, which confines Josephson vortices into a square box, and as a result they are free to move in the two dimensional channels. We fabricated such long junctions with $L=20-40 \mu m$ and have measured $c$-axis transport characteristics. We have found that Josephson flow resistance $R_f$ suddenly suppressed at the intermediate field region of 1-2 T, then begins to reappear gradually as field is increased. The sharp lock-in transition as a function of angle appearing below it where the periodic oscillation of $R_f$ is seen, becomes immediately broad and a round peak above it, where the periodic oscillation of $R_f$ is no longer observable. It seems that the transition field becomes lower as $L$ is increased so that in short junctions it cannot be observed in a field region up to 6 T.

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