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Dynamics of Josephson vortices mediated with pancake vortices

KAZUTO HIRATA, National Institute for Materials Science, SHUICHI OOI, TAKASHI MOCHIKU, PHYSICAL PROPERTIES TEAM — Josephson vortices (JVs) flow very fast with a velocity up to tenth of the light velocity in Bi-2212. If the motion of JVs can be controlled, high-speed signal processing will be achieved. We have tried to apply symmetrical pinning centers in space and time-asymmetric input signals for controlling a dynamical behavior of JVs in Bi-2212. We have shown the periodic oscillations in JV flow-resistance against magnetic field in Bi-2212 (PRL89(2002)247002), which persist in wide range of temperature and magnetic field. Introducing pancake vortices (PVs) into JV system in Bi-2212, the JV flow-resistance abruptly decreases, because the JVs interact with the PVs strongly and the PVs are pinned in intrinsically existed pinning centers in Bi-2212. However, when the input current (signal) with two frequencies is applied, a finite dc voltage can be obtained even without the flow-resistance. This leads to a rectification effect in the JVs' motion by the PVs. The nonlinearity in I-V characteristics induces the rectification effect with time-asymmetric input signals of two harmonics. This may open a new application of HTSCs.

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