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The stability of current filaments in $Bi_2Sr_2CaCu_2O_8$ observed via luminescent thermal microscopy[1] YANG HAO, TIMOTHY BENSEMAN, ALEXEI KOSHELEV, VITALII VLASKO-VLASOV, WAI-KWONG KWOK, ULRICH WELP, Argonne Natl Lab, COURTNEY KEISER, Northern Iowa University, BORIS GROSS, MATTHIAS LANGE, DIETER KOELLE, REINHOLD KLEINER, University of Tuebingen, KAZUO KADOWAKI, University of Tsukuba — Stacks of Intrinsic Josephson Junctions (IJJs) in $Bi_2Sr_2CaCu_2O_8$ (Bi-2212) designed as emitters of THz-radiation are prone to strong self-heating and thermal instability due to the poor thermal conductivity and semiconducting resistivity along the c-axis. Recent theory and experimental evidence indicate a possible correlation between strong self-heating and THz power emission. Here we study the temperature distribution in stacks of IJJs using current-voltage (I-V) characteristics and direct thermal imaging. At low bias currents and at low temperature, we observe the nucleation of small hot-spots near the corners or edges of the sample. These hot-spots carry 20-30% of the entire bias current thus forming current filaments. With increasing current and at elevated temperatures the size of the hot-spot increases and it moves to the center of the sample. These observations are in excellent agreement with theoretical analysis regarding the stability of current filaments.

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