Seidler, Rosenbaum, and Crabtree Reply: Two major results emerged from our magnetization and magnetization relaxation studies of untwinned single crystals of $YBa_2Cu_3O_{7-\delta}$ at mK temperatures in high magnetic fields [1]. First, we found that the normalized relaxation rate $S(T,H)$ vanishes abruptly at sufficiently high H and low T. Second, we observed that several kOe subsequent to the disappearance of measurable relaxation, magnetization jumps occurred, corresponding to the "slip-stick" motion of thousands of vortices under our gaussmeter.

Although the occurrence of magnetization jumps in type II superconductors at low reduced temperatures is well studied in conventional superconductors [2] and, to a lesser extent, in the cuprates [3], our high quality untwinned single crystals demonstrate several features which we believe to be unique. First, the onset field for magnetization jumps is only very weakly sensitive to magnet ramp rate. Second, magnetization jumps occur on different regions of internal magnetic field B on the increasing and decreasing branches of a hysteresis loop. Third, the detailed pattern of magnetization jumps is highly repeatable. As a consequence of these unusual properties, we have proposed that the magnetization jumps may be dynamically rather than thermally triggered [1].

In his Comment [4], Mitin questions the extent to which our data may result from simple deviations from the Bean critical state and from self-heating effects associated with the motion of vortices. We first will respond to the author's concerns relating to the disappearance of $S(H,T)$ and then turn to the question of the nature of the observed magnetization jumps.

Although it is certainly true that "a reduction of 3%–5% with respect to the complete Bean critical state" would result in a significant diminution of relaxation, we disagree with Mitin that such a change in initial conditions is "negligible," by which we assume that he means undetectable. Such a change in magnetization would correspond to an approximately 100 Oe change in B, well within our Hall probe resolution [1]. We argue against the extreme case of small magnetization jumps occurring asymmetrically in the sample and away from our micro-Hall probe. We recently have performed spatially resolved studies of other $YBa_2Cu_3O_{7-\delta}$ single crystals with a Hall probe array [5]. In these measurements, every observed magnetization jump gave a clear signature at every Hall probe; all jumps proceed to magnetizations close to the estimated reversible magnetization.

We now address the very difficult question of how one is to discern dynamically triggered from thermally triggered instabilities. We do not dispute that significant self-heating is associated with the sudden vortex motion [6], nor that simple thermal run-away is a likely contributor to the rapid dynamics once begun. Rather, we underscore three features of the observed magnetization jumps which we believe to be difficult, if not impossible, to explain by a thermally triggered mechanism.

First, we have extended our previous measurements on the magnet ramp rate (dH/dt) dependence of the onset field H_{up} for the magnetization jumps. We find that H_{up} only decreases from 57 to 54 kOe upon changing dH/dt by more than an order of magnitude from 1 to 23 Oe/sec. This excludes the simplest model of homogeneous sample heating from vortex motion where the bulk shielding currents are caused to exceed $J_c(T)$ [6].

Second, we observe that magnetization jumps on the increasing and decreasing branches of $B(H)$ hysteresis loops occur in different regions of internal magnetic field B, whose lower bounds are separated by several times the irreversibility of the sample. As thermally triggered instabilities are necessarily mediated by the sample's thermal conductivity and heat capacity which are single valued functions of B_{ave}, this poses great difficulties for all thermally triggered models. In [7], magnetization jumps are reported in the ternary superconductor $Pb_{1.2}Mo_{6.4}S_8$. Although these jumps occur in different regions of magnetic field H, the reported sample dimensions and J_c indicate that the jumps instead occur in very similar if not identical regions of B.

Finally, we reiterate that the detailed structure of the magnetization jumps is repeatable [1]. Hence, it appears to us that a more natural comparison can be made to systems with dynamical instabilities (e.g., sandpiles), where instability onset can be a function of measurement history and jump structure can be robust under cycling.

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