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Flux pinning and Critical current density in $La_{2-x}Sr_xCuO_{4+d}$
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— We have studied the magnetic characteristics of the critical states in a series of samples of the type $La_{2-x}Sr_xCuO_{4+d}$ that is doped with both Sr and excess O incorporated using electrochemistry. These samples spontaneously phase separate and show both a superconducting phase with T_C near 40 K and a magnetic phase with T_M near 40 K. Our previous studies established that the superconducting phase is similar to an optimally doped sample while the magnetic phase is consistent with the static spin density wave reported for x=1/8 Sr or Ba doped samples. Magnetization data at various temperatures showed large reversibility in all the samples. The critical current densities $J_C(0)$ values were at least an order of magnitude smaller than that of the reported values for $YBa_2Cu_3O_{7-d}$and $La_{2-x}Sr_xCuO_4$. At higher fields J_C(H) was smaller indicating the existence of weak flux pinning in the system. Based on our magnetization data we conclude that the vortex lattice pinning is different from non-phase separated cuprates. This work was partially supported by the US-DOE through contract DE-FG02-00ER45801 and the Cottrell Scholar Program of the Research Corporation.

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