Analysis of Resistive Transition to the Superconducting State of a $(Tl_{0.6}Pb_{0.24}Bi_{0.16})(Ba_{0.1}Sr_{0.9})_2Ca_2Cu_3O_y$ film on single-crystalline lanthanum aluminate

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The resistive transition from a normal to the superconducting state of high temperature superconductors (HTS) is almost always significantly broadened as compared to the low temperature superconductors. Especially, when the applied magnetic field or the large flowing current is present. The field-broadened resistive transition may be described by the following equation [1]: $\Delta T = C\,H^m + \Delta T_0$, where the width of the resistive transition was usually defined by the formula: $\Delta T = T_{90\%} - T_{10\%}$. The value of m should be 2/3, but was found to depend on some properties of a superconductor. ΔT_0 is the width of the resistive transition at zero applied magnetic field and the coefficient C depends on the critical current at zero magnetic field and on the critical temperature.

In this paper we try to fit the resistive transition as a function of both the temperature and the applied magnetic field using the two models: first, based on the Ambegaokar and Halperin theory [2] that describes the resistive transitions by the modified Bessel function and second, based on Anderson and Kim theory [3] for the critical state (flux creep) represented by an exponential formula. As an example the experimental results fitted by the Bessel function are shown in figure 1.

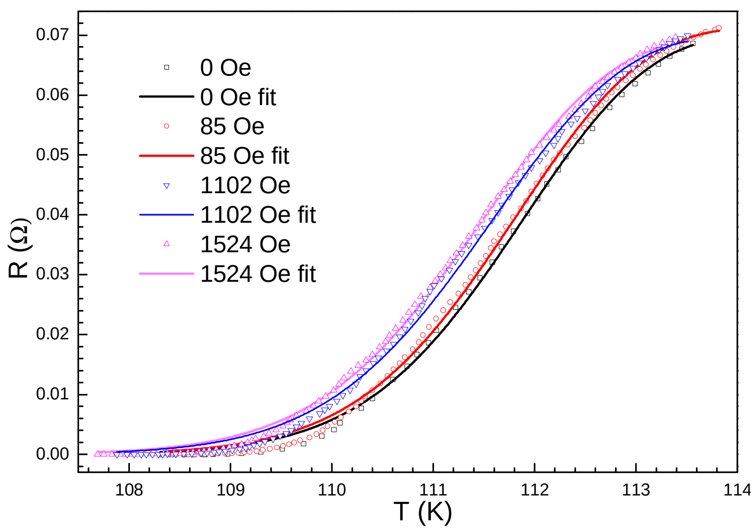

Fig. 1 Resistivity *versus* temperature of a $(Tl_{0.6}Pb_{0.24}Bi_{0.16})(Ba_{0.1}Sr_{0.9})_2Ca_2Cu_3O_y$ film on single-crystalline lanthanum aluminate for magnetic fields $H \parallel a\text{-}b$ (The data points are from Fig. 9 of Ref. [1]). The solid lines present fitting to the Ambegaokar and Halperin theory [2].

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2. V. Ambegaokar and B.I. Halperin, *Phys. Rev. Lett*., **22** (1969) 1364.
3. P.W. Anderson and Y.B. Kim, *Rev. Mod. Phys*., **36** (1964) 39.