Muon Spin Relaxation Study of Superconducting $Bi_2Sr_{2-x}La_xCuO_{6+\delta}$

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We have performed μSR measurements on superconducting samples of $Bi_2Sr_{2-x}La_xCuO_{6+\delta}$ (Bi2201) in transverse magnetic fields (200 G - 2 kG) for x =0.2,0.4,0.6. Our results indicate that Bi2201, with its low superfluid density, follows the trend of other high-T_c superconductors where T_c is nearly proportional to $\sigma_{T\to 0}$. This is in contrast with recent measurements on YBCO thin films (cond-mat/0410135) where T_c follows a power law dependence on the superfluid density. We also report detailed studies on angular averaging of σ for moderately oriented ceramic specimens, substitution of La with Eu, as well as comparison with recent H_c1 measurements in highly underdoped YBCO (Liang *et al.* PRL. **94**, 117001 (2005)).

High TF-μSR has been performed on a number of the cuprates, revealing strong field-induced quasi-static magnetism in the underdoped and Eu doped $(La,Sr)_2CuO_4$ and $La_{1.875}Ba_{0.125}CuO_4$, existing well above T_c and T_N. Additional μSR measurements have been performed on a single crystal specimen of Bi2201 ($x = 0.4$) in a high transverse magnetic field of 5 T parallel to the c-axis for comparison. The nearly temperature-independent and very small relaxation rate observed in Bi2201 above T_c rules out a hypothesis that the field-induced relaxation is directly proportional to the magnitude of the Nernst coefficient, a measure of the strength of dynamic superconductivity.

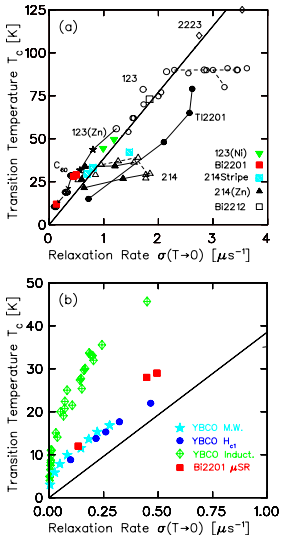

Fig. 1. The transition temperature T_c of HTSC and other type-II superconductors plotted against the muon spin relaxation rate $\sigma \propto n_s/m^*$ at $T \to 0$.

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