

## Search for the preformed-pair state in the pseudogap regime above $T_c$ using c-axis tunneling in $\text{Bi}_2\text{Sr}_2\text{CaCu}_2\text{O}_{8+d}$ single crystals

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The normal state of high- $T_c$  superconducting materials has been believed to contain important clues to finding the correct mechanism of the high- $T_c$  superconductivity. One example is the existence of pseudogap in the normal state even above  $T_c$ , as observed in various measurements such as photoemission spectroscopy and tunneling conductance. In this pseudogap regime the existence of preformed pairs only with local phase coherence has been debated. Recently Choi, Bang, and Campbell[1] have proposed the occurrence of the zero-bias conductance enhancement due to Andreev quasiparticle reflection from the preformed pairs even with the local phase coherence. In this study we examine the zero-bias enhancement of the differential conductance near or slightly above  $T_c$ , using c-axis tunneling in mesa structure of  $\text{Bi}_2\text{Sr}_2\text{CaCu}_2\text{O}_{8+d}$  single crystals. In slightly overdoped samples zero-bias conductance enhancement (ZBCE) has been observed over a range of 2 K above  $T_c$ . In contrast, in underdoped samples with  $T_c \sim 72$  K the ZBCE appears over a range of 5-6 K above  $T_c$ , a much wider temperature range than in overdoped samples. This result may pose as positive signs of the existence of preformed pairs in the normal state of high- $T_c$  superconducting materials.

[1] H.-Y. Choi, Y. Bang, and D. K. Campbell, Phys. Rev. B61, 9748 (2000).