Determination of the superconducting gap in $Bi_2Sr_{2-x}La_xCuO_{6+\delta}$ ($x \sim 0.4$) from low-temperature specific heat

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Low-temperature specific heat (LTSH) of the monolayer high-T_c superconductor $Bi_2Sr_{2-x}La_xCuO_{6+\delta}$ has been measured close to the optimal doping point ($x \sim 0.4$) in different magnetic fields. The identification of both a T^2 term in zero field and a $\sqrt{H}$ dependence of the specific heat in fields is shown to follow the theoretical prediction for d-wave pairing, which enables us to extract the slope of the superconducting gap in the vicinity of the nodes (v_Δ, which is proportional to the superconducting gap Δ_0 at the antinodes according to the standard $d_{x^2-y^2}$ gap function). The v_Δ or Δ_0 (~ 12 meV) determined from this bulk measurement shows close agreement with that obtained from spectroscopy or tunneling measurements, which confirms the simple d-wave form of the superconducting gap.[1] Together with previous findings in $La_{2-x}Sr_xCuO_4$ over a wide range of doping, our studies demonstrate the virtue of LTSH as a bulk method to probe the superconducting gap near the nodes in high-T_c cuprate superconductors.

[1]Y. Wang, Z.-Y. Liu, C.-T. Lin, and H.-H. Wen, Phys. Rev. B **83**, 054509 (2011).