HIGH-TC SUPERCONDUCTIVITY IN ENTIRELY END-BONDED CARBON NANOTUBES

One-dimensional (1D) systems face some obstructions that prevent the emergence of superconductivity, such as Tomonaga-Luttinger liquid states and Peierls transition. Carbon nanotubes (CNs) are one of the best candidates for investigating the possibility of 1D superconductivity and its interplay with such obstructions. Only two groups to our knowledge, however, have experimentally reported superconductivity [1], [2]. In contrast, interestingly B-doped diamond and CaC6 could exhibit superconductivity with T_c of about 11K [3].

Here, we report that entirely end-bonded multi-walled carbon nanotubes (MWNTs) can exhibit superconductivity with a T_c as high as 12 K [4], which is approximately 30 times greater than T_c reported in [1]. We also find that the emergence of this superconductivity is very sensitive to the junction structures of the Au electrode/MWNTs. This reveals that only MWNTs with optimal numbers of electrically activated shells can allow superconductivity due to intershell effects.

Application of this superconductive MWNT to quantum computation (flux-controlled qu-bit) will be also shown.

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[4] J.Haruyama et al., Phys. Rev. Lett. 96, 057001 (2006)