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Odd-frequency Superconducting Order Parameter in Boron-doped Nanocrystalline Diamond Films

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概　要

Nanocrystalline diamond films can be described as a granular superconducting system with Josephson's tunneling between superconducting diamond grains separated by a very thin layer of disordered sp2 hybridized (i.e. graphene-like) carbon. Presently we concentrate on electrical transport properties of heavily boron–doped nanocrystalline diamond films around the superconducting transition point based on the Berezinskii-Kosterlitz-Thouless transition. The magnetoresistance (MR) of these films was found to change from negative to a positive value at a particular temperature close to this transition which is explained through the transition from weak localization to weak anti-localization effect. Through the application of a low bias current negative magnetoresistance (MR) features can be seen with periodic oscillatory features these are attributed to tunneling associated with non-s wave order parameters in a multi-junction system. Presence of an odd frequency superconducting order parameter has been claimed from pronounced zero bias conductance peak as well as spin valve-like effect in MR. Ultimately from the angle-dependent change of critical temperature as well as the MR peaks we demonstrate signature of spin triplet superconductivity in these films. The microstructure essentially forms a graphene on diamond system which has been suggested as a good candidate for topological insulator. Hence the superconducting nanodiamond heterostructures can be useful for developing topological qubits for quantum computing, some device concepts are thus discussed.

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