Highlights

RESEARCH AREA 3 - Quantum Science and technologies - 2023

Investigation of dark count rate in NbRe microstrips for single photon detection

P. Ercolano[1], C. Cirillo[2], M. Ejrnaes[3], F. Chianese[4], D. Salvoni[5], C. Bruscino[1], R. Satariano[3], A. Cassinese[1,6], C. Attanasio[7], G.P. Pepe[1] and L. Parlato[1*]

[1]Dipartimento di Fisica "E. Pancini", Università degli Studi di Napoli Federico II, Napoli, Italy
[2]CNR-SPIN Institute of Superconductors, Innovative Materials and Devices, Fisciano, Salerno, Italy
[3]CNR-SPIN Institute of Superconductors, Innovative Materials and Devices, Pozzuoli, Italy
[4]Chalmers University of Technology, Gothenburg, Sweden
[5]Photon Technology (Zhejiang) Co., Ltd. Jiashan, Zhejiang, China
[6]Istituto Nazionale di Fisica Nucleare, Sezione di Napoli, Napoli, Italy
[7]Dipartimento di Fisica "E. R. Caianiello", Università degli Studi di Salerno, Fisciano, Salerno, Italy

SUPERCONDUCTOR SCIENCE AND TECHNOLOGY 36, 105011
(2023)

Superconducting microstrip single photon detectors (SMSPDs) received great interest since they are expected to combine the excellent performance of superconducting nanostrip single photon detectors with the possibility to cover large active areas using low-cost fabrication techniques. In this work, we fabricated SMSPDs based on NbRe to investigate the role of vortices in the dark counts events in this innovative material and in devices with micrometer size. We realized devices with different layouts, namely single microstrips and pairs of parallel microstrips. The energy barriers related to the motion of single vortices (VS) or vortex–antivortex pairs (VAP), responsible of detection events, have been determined and compared with the ones of similar devices based on different materials, such as MoSi, WSi and NbN. The analysis confirms the high potential of NbRe for the realization of superconducting single photon detectors with large areas.

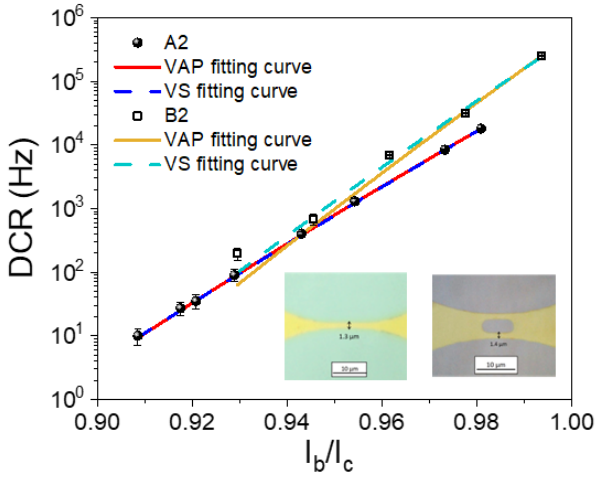

Fig. 1: Dark Count Rate (DCR) vs the normalized bias current for the single strip A2 (black solid circles) and the pair of parallel strips B2 (black open squares), at T = 1.79 K and T = 1.57 K respectively. The solid and dashed lines are the VAP. Inset: microscope photo of the NbRe single strip A2 (left) and of the pair of parallel strips B2 (right) realized by optical lithography.

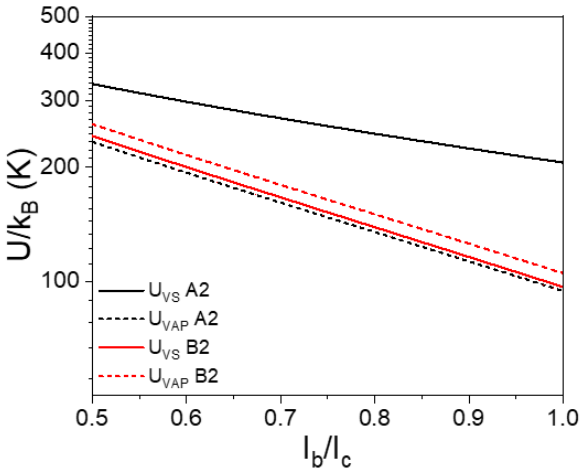

Fig. 2: Energy barriers for the single strip A2 (black lines) and the pair of parallel strips B2 (red lines), at $T = 1.79\ K$ and $T = 1.57\ K$, respectively. Continuous (dashed) lines correspond to VS (VAP) processes.

Consiglio Nazionale delle Ricerche
SPIN