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Superconducting single photon detectors integrated on crystalline silicon carbide

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Silicon carbide (SiC) is among the most promising optical material for the realization of classical and quantum photonics, due to the simultaneous presence of quantum emitters and a non-centrosymmetric crystal structure. In recent years, progress have been made in the development of SiC integrated optical components making this a mature platform for the implementation of quantum experiments on chip. Toward this scope, the realization of a single photon detector that can be implemented on top of a photonic circuit is essential to achieve a monolithic integration of all the fundamental building blocks required for photonic quantum technologies. Thanks to a new measurement approach that makes use of two alignment mirrors and a single-mode fiber array , here we characterize electro-optically SNSPDs realized on top of 3C SiC using NbN deposited by DC magnetron sputtering. This alignment approach allows the testing of multiple SNSPDs fabricated on top of less fabrication-friendly materials, without the use of expensive and bulky cryogenic positioners. The 3x3 (μm)^2 active area of the realized SNSPD allowed a quasi-saturated detection efficiency at telecom wavelengths at the operating temperature of 2.9K, meaning that high detection efficiency can be obtained by the engineering of the optical system. This is a further step towards the realization of photonic circuit using SiC as monolithic platform for large quantum experiments, interfacing solid-state emitters, reconfigurable linear component and efficient single photon detectors.

Less than 5 years of experience since completion of Ph.D

Y

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