All-fiber device for single-photon detection

Zhenda Xie, Labao Zhang, Kunpeng Jia, Yue Dai, Peiheng Wu, Shi-ning Zhu

School of Electronic Science and Engineering, National Laboratory of Solid State Microstructures, Key Laboratory of Intelligent Optical Sensing and Manipulation, School of Physics, College of Engineering and Applied Sciences, and Collaborative Innovation Center of Advanced Microstructures, Nanjing University, Nanjing 210093, P. R. China

Fiber components form the standard not only in modern telecommunication but also for future quantum information technology [1-5]. For high-performance single-photon detection, superconducting nanowire single-photon detectors (SPDs) are typically fabricated on a silicon chip and fiber-coupled for easy handling and usage. The fiber-to-chip interface hinders the SPD from being an all-fiber device for full utilization of its excellent performance.

Here, we report a scheme of SPD that is directly fabricated on the fiber tip. A bury-and-planar fabrication technique is developed to improve the roughness of the substrate for all-fiber detectors' performance for single-photon detection with amorphous molybdenum silicide (MoSi) nanowires. The low material selectivity and universal planar process enable fabrication and packaging on a large scale. Such a detector responds to a broad wavelength range from 405 nm to 1550 nm at a dark count rate of 100 cps. The relaxation time of the response pulse is ~ 15 ns, which is comparable to that of on-chip SPDs. Therefore, this device is free from fiber-to-chip coupling and easy packaging for all-fiber quantum information systems.

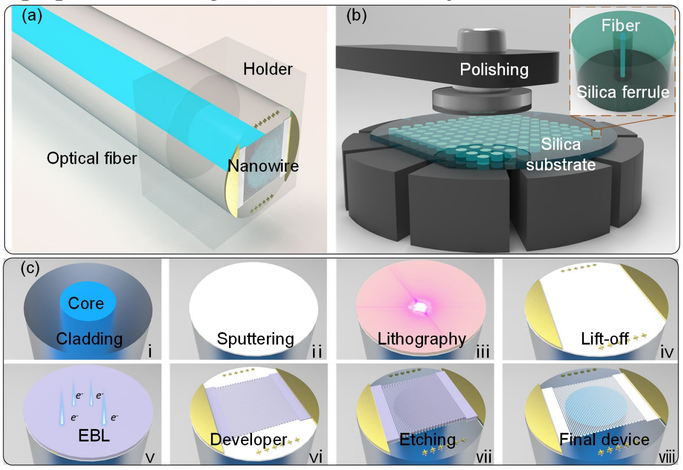

Fig. 1: *(a) TEM of the MoSi film and Nb5N6 film on the fiber tip. (b) Optical microscope image of the core on the fiber. (c) Photograph of an FSPD. Inset: optical microscope image of FSPD. Scale bar: 250 μm. (d) IV trace curve of the FSPD..*

Funding acknowledgement

This work is supported by the National Key R&D Program of China, the National Natural Science Foundation of China.

References

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