One-dimensional quantum dot array integrated with charge sensors in an InAs nanowire

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In this work, a linear quintuple quantum dot (QQD) array integrated with two single quantum dot (QD) charge sensors is made in an InAs nanowire via a fine finger-gate technique. In double quantum dot configurations, we see synchronized responses between direct transport current through the double quantum dots and the signal of corresponding charge sensors, confirming the functionality of the charge sensors. After that, a QQD is tuned up and its charge configurations are fully mapped out with the help of the sensitive charge sensors despite a hardly detectable direct transport through the QQD. Then, we demonstrate that the level of each dot in the QQD is able to be addressed individually by using the so-called "virtual gate". In addition, the interaction between multiple dots is revealed when the levels of these dots are tuned simultaneously. The highly controllable one-dimensional quantum dot array achieved in this work lays a foundation for multiple charge/spin qubit operations in nanowire systems in the future [1].

References

[1] D. Loss, D. P. DiVincenzo, Phys. Rev. A 57, 120 (1998).

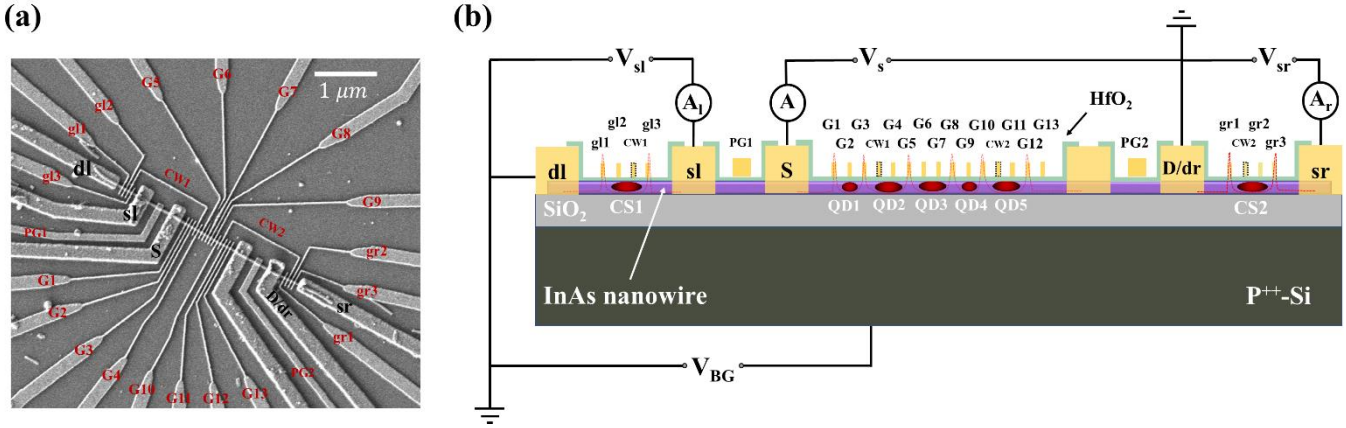

Fig.1. a) SEM image of the device. b) Cross-sectional schematic view of the device and measurement circuit setup. The locations of the sensor QDs and of the QDs formed in the QQD array are marked by red ovals.