Charge sensing readout of Ge quantum dots

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Abstract

Germanium arises as a promising material for complex spin qubits architectures [1], by combining high mobilities, low hyperfine interactions and a small effective mass. An efficient readout of Ge quantum dots devices can be achieved by implementing a RF-reflectometry setup on a local charge sensor [2]. Here, we discuss the matching of the resonant circuit used for the reflectometry and its sensitivity to the variation of the charge sensor resistance [3]. We characterize the charge sensitivity and the charge noise of the sensor [4], and evaluate its performances when sensing a double quantum dot. We take advantage of the numerous gates of the device to tune the coupling between the sensor and the double quantum dot in order to increase the signal-to-noise ratio. Our optimization enables us to probe the few-hole regime and to perform spin-to-charge conversion by means of Pauli spin blockade.

References

[1] G. Scappucci et al, Nature Review Materials, 6 (2021) 926-943
[2] R. Schoelkopf et al, Science, 280 (1998) 1238-1242
[3] Y. Liu et al, Phys. Rev. Appl, 16 (2021) 014057
[4] M. Lodari et al, Materials for Quantum Technology, 1 (2021) 011002

Figures

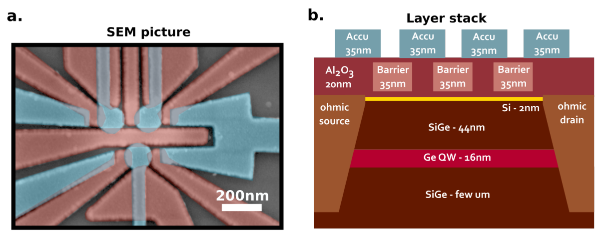

Figure 1: Coloured SEM picture and layer stack of the of the measured device.

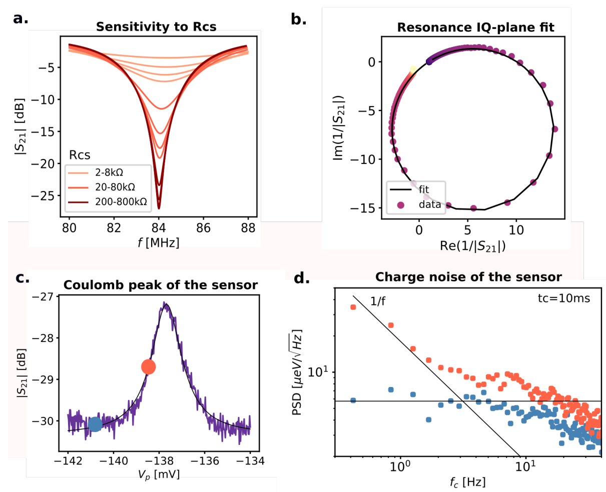

Figure 2: Simulated and measured properties of the resonant circuit and the charge sensor.

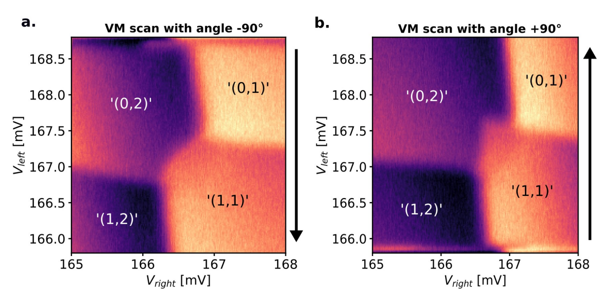

Figure 3: Pauli spin blockade signature for two different scan angles in video mode.