

Bi-layers in Thin Silicon Quantum Wells

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Development of silicon-on-insulator (SOI) technology has enabled fabrication of silicon heterostructures where thin single crystalline Si film is sandwiched between amorphous SiO₂ layers. This kind of SiO₂-Si-SiO₂ quantum well provides a unique material system where electron density can be tuned in a broad range due to high potential barriers formed by the SiO₂ layers. In this work we examine transport properties of single [1] and double gate SiO₂-Si-SiO₂ quantum wells. We will discuss the properties of electron-electron [2-4] and electron-hole [5] bi-layers formed in these gated structures. In Fig. 1 are shown a cross-sectional TEM image of such double gated device together with contour plots of conductivity as a function of top and back gate voltages measured from devices with 7 nm and 14 nm thick Si channels.

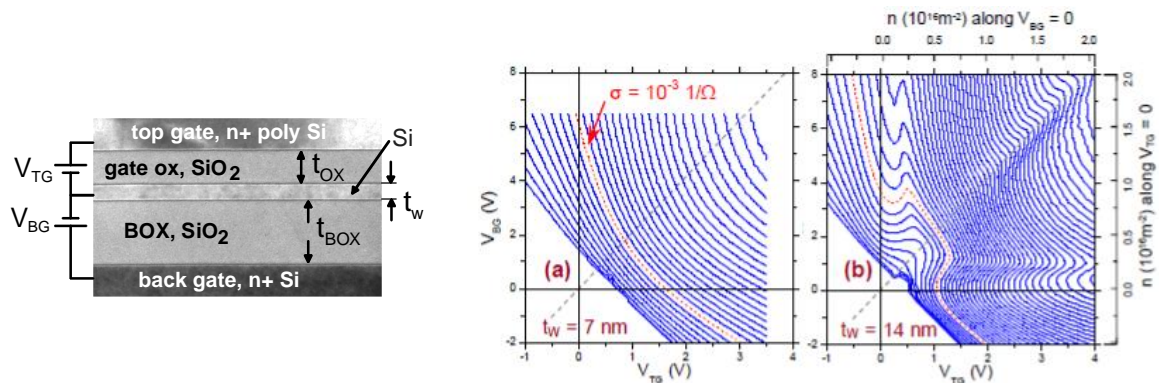


Fig. 1 (left) Cross-sectional TEM image of a double gate SOI device. The thickness of the channel is 18 nm. (right) Contour plots of conductivity measured at 270 mK from devices with 7 nm and 14 nm thick channels. The non-monotonic features arising from the bi-layer are clearly visible in the plot measured from the 14 nm thick device.

References

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