Evaluation of Lateral Ni Diffusion in Si Nanowire Schottky Contact

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Si Nanowire (SiNW) FET, have attracted much attentions as one of the candidates for future VLSI technologies, owing to its ability to suppress the off-state leakage current and increase in on-current under low operating voltage. The increase in access resistance in SiNW MOSFET is one of the issues to be solved and Ni silicide has been used to reduce the resistance. However, the formation and the lateral diffusion of Ni to form silicide with SiNW at Source/Drain region are still unknown [1, 2]. In this paper, evaluation of lateral Ni diffusion into SiNW has been evaluated.

Line patterns with different widths ranging from 60 to 100 nm were formed on a SOI substrate (SOI and BOX thickness of 61 and 145 nm, respectively) by dry etching with a hard mask. Wafer was then subjected to thermal oxidation in dry O_2 at 1100 ^{o}C, resulting in the formation of SiNWs with 10 nm in diameter. After striping a part of the formed SiO_2 with buffered HF to expose SiNWs, 10-nm-thick Ni film was deposited by magnetron sputtering. Silicidation annealing was performed by rapid thermal annealing (RTA) in forming gas (N_2/H_2=97%/3%) at 450 ^{o}C for 30 sec. The unreacted Ni was removed by H_2SO_4/H_2O_2 mixture. Lateral Diffusion of Ni into SiNWs was evaluated by scanning electron microscope (SEM).

A strong diameter dependence on the lateral growth of Ni silicide was observed. The lateral growth for SiNW with diameter of 10 nm revealed an enhanced diffusion over 200 nm, where 90 nm of growth was confirmed at a SiNW with a diameter of 20 nm. This result indicates the necessity of precise control of SiNW diameter for lowering the access resistance.

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