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Capacitance Measurement for FETs of Individual SWNTs with Altra-Thin ALD High- κ Dielectric YUERUI LU, RYAN TU, YOSHIO NISHI, HONGJIE DAI, Stanford University — Recently, we have been able to approach the ultimate vertical scaling limit of carbon nanotube field effect transistors (FETs) and reliably achieve $S \sim 60$ mV/decade at room temperature, by non-covalent functionalization of single walled carbon nanotubes (SWNTs) with poly-T DNA molecules, which can impart functional groups of sufficient density and stability for uniform and conformal ALD of high- κ dielectrics (HfO_2) with thickness down to 2-3 nm on SWNTs. Moreover, very small top gate stack capacitance (~ 200 aF) of the SWNT FET has been successfully measured directly, using a special technique. The quantum capacitance oscillation with top gate voltage bias is clearly observed, due to the large geometric capacitance comparable to or even larger than the quantum capacitance of the SWNT. Theoretical quantum transport model and calculation fit very well with the experiment data. In addition, the mobility of the SWNT FETs at room temperature is also extracted by the capacitance measured directly.

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