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Gate field induced switching of electronic current in Si-Ge Core-Shell nanowire quantum dots: A first principles study KAMAL B DHUNGANA, University of Iowa, MEGHNATH JAISHI, RANJIT PATI, Michigan Technological University — Core-shell nanowires are formed by varying the radial composition of the nanowires. One of the most widely studied core-shell nanowire groups in recent years is the Si-Ge and Ge-Si core-shell nanowires. Compared to their pristine counterparts, they are reported to have superior electronic properties. For example, the scaled ON state current value in a Ge-Si core-shell nanowire field effect transistor (FET) is reported to be three to four times higher than that observed in state-of-the-art-metal oxide semiconductor FET (MOSFET) (*Nature, 441, 489 (2006)*). Here, we study the transport properties of the pristine Si and Si-Ge core-shell nanowire quantum dots of similar dimension to understand the superior performance of Si-Ge core-shell nanowire field effect transistor. Our calculations yield excellent gate field induced switching behavior in current for both pristine Si and Si-Ge core-shell hetero-structure nanowire quantum dots. The threshold gate bias for ON/OFF switching in the Si-Ge core-shell nanowire is found to be much smaller than that found in the pristine Si nanowire. A single particle many-body Green's function approach in conjunction with density functional theory is employed to calculate the electronic current.

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