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Absorption and Photoluminescence in very small diameter Si Nanowires[1] K.W. ADU, H.R. GUTIÉRREZ, P.C. EKLUND, The Pennsylvania State University, University Park, Pennsylvania 16802, USA — Optical absorption and photoluminescence spectra on 3 sets of crystalline Si nanowires with most probable diameter 3.5 nm, 5.5 nm and 9 nm are presented. In the optical absorption spectra, apart from the direct gap absorption at Er1 $\sim$ 3.4 eV and Er2 $\sim$ 4.2 eV, we observed two additional strong peaks near 1.5 eV and $\sim$2.5 eV. The 3.4 and 4.2 eV peaks exhibit a weak but clear blue shift with decreasing wire diameter. Interestingly, the anomalous 1.5 and 2.5 eV peaks increase in intensity with decreasing nanowire diameter. It is also interesting that the 1.5 eV peak does not shift with decreasing wire diameter. This behavior leads us to tentatively assign this structure to Si-SiO2 interface states. On the other hand, the $\sim$2.5, 3.4 and 4.2 eV absorption bands exhibit a systematic blue shift with decreasing diameter. This behavior is consistent with a quantum confinement phenomenon. Structure in the photoluminescence is also observed at $\sim$1.5 and $\sim$2.4 eV. The origin of these low energy peaks will be described in terms of the band structure of Si nanowires.

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G. Chen
The Pennsylvania State University

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