The dimension and strength of a single C-C bond in carbon nanotubes

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With the measured values of coalescent temperature ($T_m \cong$ 1600 K) [1] and the product of Young's modulus with the wall (bond) thickness (Yt ≅ 0.3685 TPa·nm) [2] as well as their functional dependence on atomic coordination, bond length and bond energy [3,4], the dimension (length and thickness) and strength of a single C-C bond in a carbon single-walled nanotube (SWNT) have been determined. Solutions show that the SWNT C-C bond is ~0.143 nm thick and ~0.116 nm long (contracts by ~18.5%) associated with ~68% bond energy rise. Besides, the predicted diameter-dependence matches with observed trends of T_m-suppression and Y-enhancement of multi-walled carbon nanotubes. Findings could provide not only consistent insight into the elastic-enhancement and the coalescent-suppression of the nanotubes but also an effective way obtaining information that is beyond the capacity of currently available techniques.

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