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Inelastic X-ray Scattering Studies of Plasmons in Carbon Nanotubes[1] M.H. UPTON, R.F. KLIE, J.P. HILL, Brookhaven National Laboratory, T. GOG, D. CASA, Advanced Photon Source, Argonne National Laboratory, W. KU, Y. ZHU, M.Y. SFEIR, J. MISEWICH, Brookhaven National Laboratory, G. ERES, D. LOWNDES, Oak Ridge National Laboratory — We investigate the physical parameters controlling the low energy screening in carbon nanotubes via electron energy loss spectroscopy and inelastic x-ray scattering. Two plasmon-like features are observed, one near 9 eV (the so- called π plasmon) and one near 20 eV (the so-called $\pi + \sigma$ plasmon). At large nanotube diameters, the $\pi + \sigma$ plasmon energies depend exclusively on the number of walls and not on the radius or chiral vector. This shift indicates a change of strength of screening and the effective interaction at inter-atomic distance, and thus suggests an alternative mechanism of tuning the properties of the nanotube in addition to the well-known control provided by chirality and tube diameter.

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