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Transparency and conductivity of carbon nanotube networks JAN OBRZUT, National Institute of Standards and Technology — The conductivity of films made of single wall carbon nanotubes longer than 200 nm closely follows the percolation theory for two-dimensional (2D) networks . The scaling universal exponents describing the "percolation" transition from an insulating to conducting state with increasing concentration are consistent with 2D percolation model. A sheet of tubes about 820 nm long becomes conducting at an amazingly low concentration of about 18x10^{-9} g/cm^2. In comparison, batches of short nanotubes or mixed-length batches form more 3D networks that conduct noticeably worse. Furthermore, the conductivity percolation threshold (x_c) varies with the aspect ratio Length (L) as, $x_c \sim 1/L$, a result that is also in accordance with the percolation theory. We also show that contrary to current predictions, these sheets do not have optical properties similar to thin metallic films. Our results indicate that the correlation between the optical properties and the electrical conductivity of these sheets is again better predicted by the general percolation theory.

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