Effects of Surfactants and Alignment on the Physical Properties of SWNT Buckypaper

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Single-walled carbon nanotube (SWNT) has good mechanical strength and electrical conductivity. Surfactant help the dispersion of carbon nanotube bundles, however, remaining surfactant block the space between nanotubes and their intertube contacts. Magnetic field gives improved degree of alignment and enhance the physical properties of BP.

Carbon nanotubes are dispersed in the aqueous medium with surfactant

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Suspension was filter through membrane under the magnetic field (17.3 T, cell 4)

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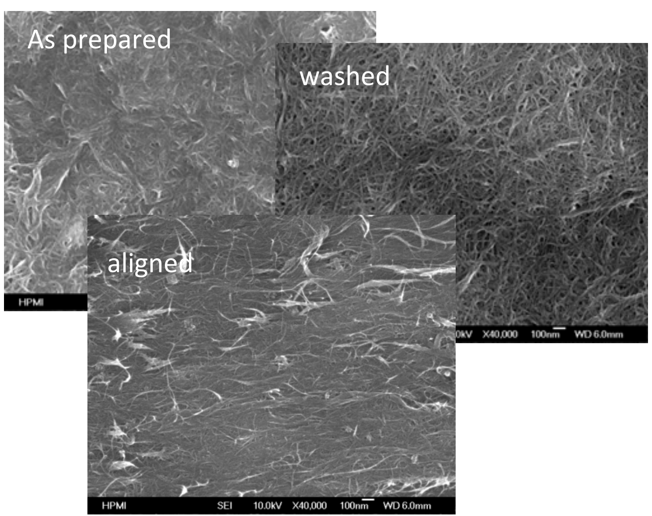
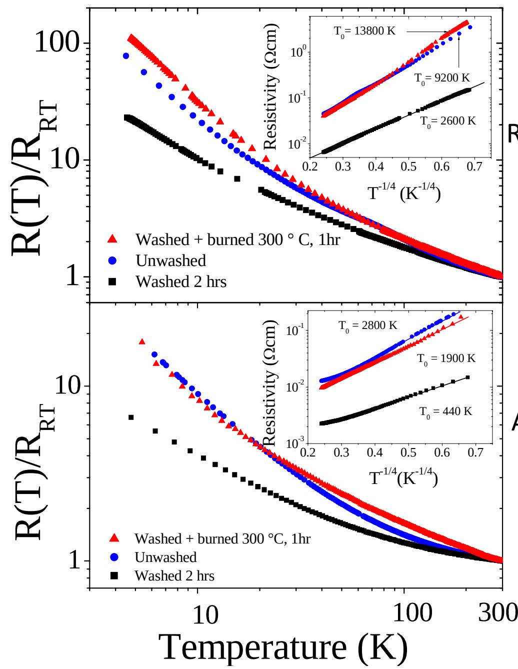
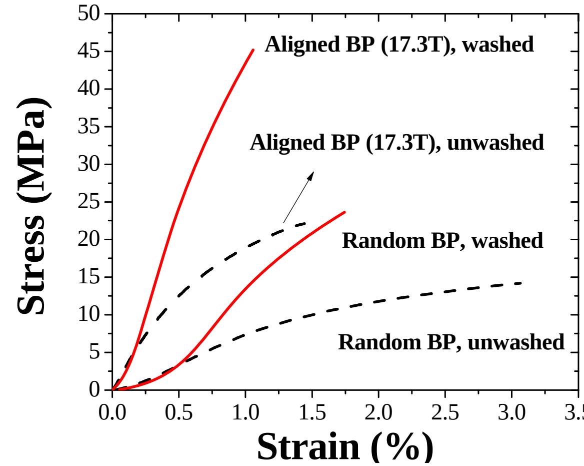
After drying, peel of the free standing carbon nanotube film (Buckypaper, BP)





Both random and aligned BPs show similar temperature dependence (inset shows based on 3D variable range hopping). Unwashed sample with surfactant has higher resistivity and larger temperature coefficient of resistivity (TCR). Removing surfactant by washing in isopropyl alcohol lower the electrical resistivity and TCR. Burning in air make damage to the SWNT.



Magnetic field improve the alignment of carbon nanotube, hence its mechanical properties. Removing the remaining surfactant gives additional enhancement of mechanical properties. Young's modulus increased from 0.90 GPa (unwashed, random) to 6 GPa (washed, magnetic field aligned) and strength was also improved from 14.2 MPa to 45.2 MPa. Strain was also reduced after removing surfactant because of increased intertube van der Waals interaction.

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