Spatially resolved transport properties of pristine and doped single-walled carbon nanotube networks

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We use a noninvasive atomic force microscopy to probe the spatial electrical conductivity of isolated junctions of pristine and nitric acid treated single-walled carbon nanotube networks (SWCNT-N). By analyzing the local IV-curves of SWCNTs and bundles with various diameters, the resistance per unit length and the contact resistance of their junctions are estimated to be 3 to 16 kΩ/µm and 29 to 532 kΩ respectively. We find that the contact resistance decreases with increasing SWCNT or bundle diameter and is dependent on the contact morphology, reaching a value of 29 kΩ at a diameter of 10 nm. A nitric acid treatment moderately dopes SWCNTs and reduces their average contact resistance by a factor of 3 while the resistance of the nanotubes remains largely unaltered. Remarkably the same treatment on a SWCNT-N shows similar reduction in the sheet resistance by a factor of 4. These results suggest that the resistance reduction mechanism is related to the contact modulation with no major impact on conductance of SWCNTs.