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Raman spectroscopy of individual freestanding single-walled carbon nanotubes of defined chiral structure

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We review the main information that we have obtained from Raman spectroscopy experiments combined with electron diffraction experiments on individual freestanding single-walled carbon nanotubes. This information concerns: the radial breathing mode vs diameter relationship; the dependence of the frequency and lineshape of the G-modes in semiconducting and metallic tubes; the evaluation of the optical transition energies for individual freestanding SWNTs. These experimental Raman results obtained on well-identified individual SWNTs are compared with other experimental data and theoretical predictions. From these data, we can define Raman criteria that allow identifying carbon nanotubes from their Raman features only. We show the efficiency of this approach: (i) to assign the (n,m) indices of individual freestanding single-walled carbon nanotubes, and (ii) to identify the (n,m) tubes organized in a small bundle.