

**Polarized Raman spectroscopy of vertically aligned single-walled carbon nanotubes**

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We have prepared up to 30  $\mu\text{m}$  thick vertically aligned single-walled carbon nanotube (VA-SWNT) films with high purity by the alcohol catalytic chemical vapor deposition (CVD) method[1][2]. In a previous polarized Raman spectroscopy study, we found anomalous anisotropic peaks such as at  $180\text{ cm}^{-1}$  for the excitation by 488 nm laser and explained them as cross polarized excitation [3]. However, recent high resolution Raman spectrum shows that the strong  $180\text{ cm}^{-1}$  is comprised by four fine sharp peaks which might be from isolated SWNTs. To clarify its origin, polarized Raman experiment is carried out using two configurations, where the orientation of the polarizer for inspecting the scattered light was parallel to (VV) and perpendicular to (VH) the polarization of the incident light. By changing the incident light orientation with respect to the VA-SWNT growth direction, two different polarization dependences were found for the radial breathing mode (RBM) peaks. The peaks at 160 and  $203\text{ cm}^{-1}$  behave consistently with the parallel excitation, while peaks at 145, 181, 244, and  $256\text{ cm}^{-1}$  exhibit the opposite behavior in the VV configuration.

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