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Polarization dependence of the optical absorption properties of single-walled carbon nanotubes

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Polarization dependent optical absorption properties of single-walled carbon nanotubes (SWNTs) have been elucidated from measurements of our vertically aligned SWNT film grown on quartz substrates. We discovered the remarkable and different polarization dependencies of UV absorption peaks observed at 4.5 eV and 5.25 eV, which are observed regardless of the diameter or preparation method of SWNTs [1]. Origins of these absorption peaks and their important relevance to the optical properties of graphite are revealed. A new method of determining a nematic order parameter of the vertically aligned SWNT films by separating out the absorption peak at 4.5 eV has been developed. Accordingly, the bare optical absorption cross-sections of the SWNTs for 0.5 - 6 eV were determined for both parallel and cross-polarized lights. The tail of the non-collinear absorption peak at 5.25 eV contributes appreciably to the absorption of cross-polarized light in the inter-subband region below 3 eV. This analysis enables quantitative evaluation of the UV absorption baselines formed in vis-NIR region from the optical absorption spectra. The author (YM) was supported through the 21st Century COE Program, "Mechanical Systems Innovation", by MEXT.

References

[1] Y. Murakami et al., Phys. Rev. Lett., 94 (2005) 087402.

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