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Scattering Process of Gas Molecules on Vertically Aligned Single-Walled Carbon Nanotubes IKUYA KINEFUCHI, YUSHI HARADA, JUNPEI KAWASAKI, KEI ISHIKAWA, JUNICHIRO SHIOMI, SHU TAKAGI, SHIGEO MARUYAMA, YOICHIRO MATSUMOTO, The University of Tokyo — Scattering process of gas molecules on quartz surfaces covered with vertically aligned single-walled carbon nanotubes (VA-SWNTs) was investigated using the molecular beam technique. We found that the surface modification with VA-SWNT films significantly enhances the energy transfer between gas molecules and surfaces at room temperature and makes the energy accommodation coefficient of helium, which tends to be small even for contaminated surfaces because of the large mass mismatch between helium and surface atom, close to unity. Our results demonstrate a potential application of VA-SWNTs as nanoscale fin structures to enhance heat transfer between gas phase and solid surfaces. As the surface temperature increases, however, the energy accommodation becomes less efficient since the small adsorption energy reduces the trapping probability of helium on carbon nanotube (CNT) bundles. The weak dependence of the accommodation coefficient on the film thickness suggests that gas molecules penetrate into the films because of their high porosity and suffer more than one collision with CNT bundles.

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