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Scattering of gas molecules on the films of vertically aligned single-walled carbon nanotubes IKUYA KINEFUCHI, YUSHI HARADA, JUMPEI KAWASAKI, KEI ISHIKAWA, JUNICHIRO SHIOMI, SHU TAKAGI, SHIGEO MARUYAMA, YOICHIRO MATSUMOTO, The University of Tokyo —
The scattering process of helium molecules on vertically aligned single-walled carbon nanotubes (VA-SWNTs) has been investigated using the molecular beam technique. The energy accommodation coefficients for VA-SWNT films on quartz substrates are remarkably high at room temperature compared to those for the bare substrates, demonstrating the effectiveness of the surface modification technique with VA-SWNT films for enhancing the energy transfer between gas molecules and surfaces in rarefied gas flows. The thickness dependence of the accommodation coefficient suggests that helium molecules penetrate the films because of their high porosity and suffer multiple collisions with carbon nanotubes. The less effective energy accommodation at elevated temperatures implies the significant decrease in the trapping probability of helium molecules on carbon nanotube surfaces during each collision because of the small adsorption potential well, which is comparable to the thermal energy at room temperature.

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