# Discontinuous Growth of Solid $^4$He From the Superfluid Phase on Graphene Nanoplatelets

A. Koga[a], Y. Shibayama[b], and K. Shirahama[a]

[a]Dept. of Phys., Keio University, Yokohama, Japan
[b]Present Address: Appl. Mat. Sci. Research Unit, Muroran Inst. of Tech., Muroran, Japan

Research has shown interesting layer-by-layer growth of solid $^4$He on graphite surfaces, even well below the bulk freezing pressure[1–3]. However, the exfoliated graphite smples (Grafoil) used in these studies consist of nanometer-sized platelets, on which the growth dynamics might be greatly influenced by the finite size and unideal substrate structure. We present a torsional oscillator study for the growth of solid $^4$He from the superfluid phase on commercially available graphene nanoplatelets with average diameters of a few $\mu$m and thickness 6 nm. Measurements from 1.65 K to 0.1 K have revealed that below 1.2 K, the growth of one solid layer occurs as a series of discontinuous steps. Some of the discontinuities are preceded by melting of up to one solid layer.

1. M.J. McKenna, T.P. Brosius, and J.D. Maynard, Phys. Rev. Lett. **69**, 3346 (1992).
2. V. Gridin, J. Adler, Y. Eckstein, and E. Polturak, Phys. Rev. Lett. **53**, 802 (1984).
3. A.M. Koga, Y. Shibayama, K. Shirahama, J. Low. Temp. Phys. **166**, 257 (2012).

Section: QS - Quantum solids

Keywords: solid $^4$He growth, layering transitions, graphene