

— Supplementary Information —

**Friction of Physisorbed Nanotubes: Rolling or Sliding?**

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**I. MOVIE CAPTIONS**

Movies report NT dynamics during lateral driving. In movies 1a–6a atoms are colored so to better visualize the motion of each NT wall. In movies 1b–6b atoms are colored by the interaction energy with graphene substrate (colorbar), so to highlight the interfacial moiré pattern.

Movie 1: Dynamics of the 55@60 DWNT in the aligned configuration.

Movie 2: Dynamics of the 55@60 DWNT in the misaligned configuration.

Movie 3: Dynamics of the 5@10@15 MWNT in the aligned configuration.

Movie 4: Dynamics of the 5@10@15 MWNT in the misaligned configuration.

Movie 5: Dynamics of the 5@...@30 MWNT in the aligned configuration.

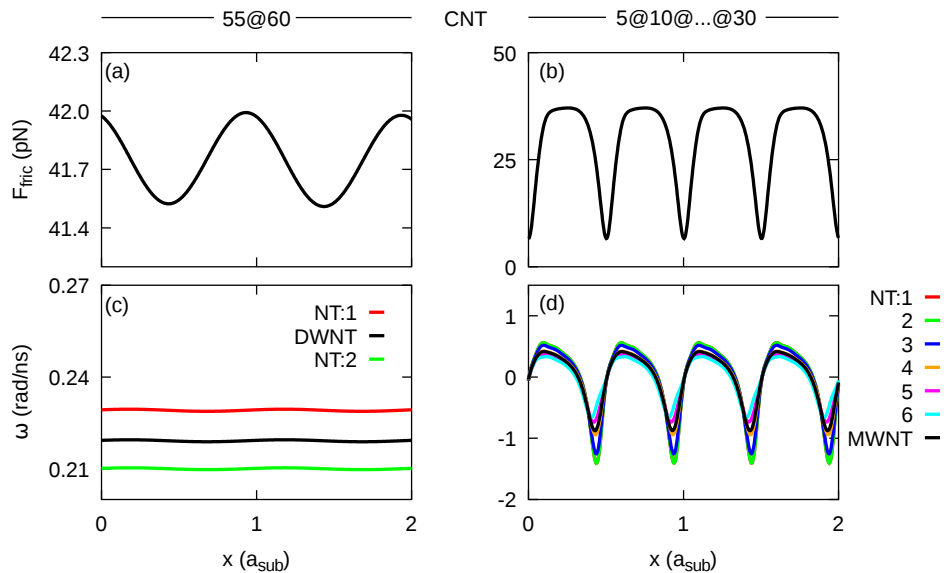
Movie 6: Dynamics of the 5@...@30 MWNT in the misaligned configuration.

**II. CARBON NT RESULTS**

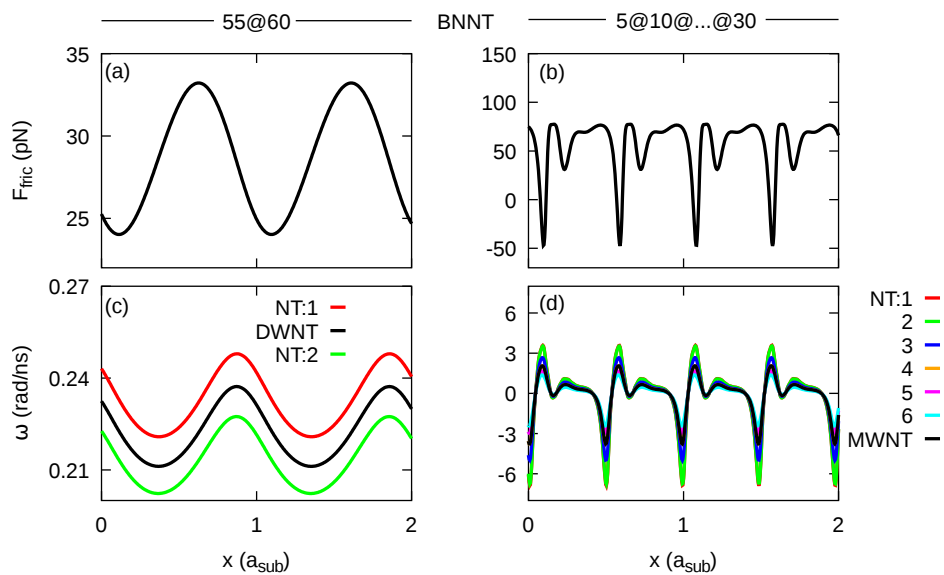
Figure S1 shows the force traces and angular velocity of a set of CNTs during lateral driving. The BNNT case is reported in Fig. S2 for comparison. The C-C interaction was described by an optimized Tersoff potential, as parametrized in Ref. 1. Simulations were conducted following the protocol reported in Section 2 of the main text.

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<sup>1</sup> L. Lindsay and D. A. Broido, *Phys. Rev. B*, 2010, **81**, 205441.



**Figure S1:** Misaligned CNT. Force traces and angular velocity of the individual walls (average in black) during lateral pulling of (left panels) the 55@60 DWNT and of (right panels) the 5@...@30 MWNT.



**Figure S2:** Misaligned BNNT. Force traces and angular velocity of the individual walls (average in black) during lateral pulling of (left panels) the 55@60 DWNT and of (right panels) the 5@...@30 MWNT.