

## Description of Additional Supplementary Files

**File Name:** Supplementary Movie 1

**Description:** Quantum molecular dynamics trajectory of ta-C surfaces lubricated with a cis-3-heptenoic acid molecule.

**File Name:** Supplementary Movie 2

**Description:** Classical molecular dynamics trajectory of ta-C surfaces lubricated with octadecane molecules.

**File Name:** Supplementary Movie 3

**Description:** Classical molecular dynamics trajectory of ta-C surfaces lubricated with octadecene molecules.

**File Name:** Supplementary Movie 4

**Description:** Quantum molecular dynamics trajectory of ta-C surfaces lubricated with a glycerol molecule.