Low Friction at the Nanoscale of Hydrogenated Fullerene-Like Carbon Films

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Friction force microscopy experiments at the nanometer scale are applied to study low friction of hydrogenated fullerene-like carbon films. The measured friction coefficients indicate that lower hydrogen concentration during preparation is beneficial to enter the low friction regime, especially in combination with only methane as precursor. Furthermore, two regions are found with distinct friction coefficients and surface roughnesses related to different surface structures. One is rich in amorphous carbon and the other is rich in fullerene-like carbon, dispersed on the same surface. Transmission electron microscopy and Raman spectroscopy images verify this observation of the two separated structures, especially with the extracted fullerene-like structures in the wear debris from macro friction experiments. It is speculated that hydrogen may tend to impair the growth of fullerene-like carbon and is therefore detrimental for lubricity.
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