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Tribological Behaviors on nano-structured surface of the diamond-like carbon (DLC) coated on soft polymer.

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Tribological behaviors of the hard film on soft substrate system were explored with the hard thin film coating of diamond-like carbon (DLC) on the soft polymer of polydimethysiloxane (PDMS). Using a plasma enhanced chemical vapor deposition (PECVD) technique, wrinkle patterns of DLC film were formed on PDMS polymer due to high compressive stress in DLC film as well as large difference of elastic moduli between DLC (~100 GPa) and PDMS (~10 MPa). The deposition time was varied from 10 sec to 10 min, at a bias voltage of 400 V_b, working pressure 10 mTorr, resulting in nanoscale roughness of wrinkle patterns with the thickness of 20 nm to 510 nm, respectively.
Nanoscale roughness effect on tribological behaviors was observed by performing a tribo-experiment using the ball-on-disk type tribometer with a steel ball of 6 mm in diameter at the sliding speed of 220 rpm, normal load of 1N and 25% humidity at ambient temperature of 25□. Friction force was measured with respect to thickness change of coated DLC thin film on PDMS. Macroscale behaviors of the friction on the nanoscale patterns from a ball-on-disk type tribometer data were compared with nanoscale load using AFM (Atomic Force Microscopy) lateral force data. It was found that with increases the thickness of DLC coating on PDMS, the coefficient of friction decreased by comparison to that of the uncoated PDMS. The wear tracks before and after tribo-test were analyzed using SEM and AFM.

Keywords
DLC
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