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

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Abstract

Tribological behaviors of the hard film on soft substrate system were explored using the hard thin film of diamond-like carbon (DLC) coated on the soft polymer of polydimethysiloxane (PDMS). A DLC film with the Young's modulus of 100 GPa was coated on PDMS substrate with Young's modulus of 10 MPa using plasma enhanced chemical vapor deposition technique. The deposition time was varied from 10 sec to 10 min, resulting in the thickness of 20 nm to 510 nm, respectively, at a bias voltage of 400 V_b, working pressure 10 mTorr. Nanoscale wrinkle patterns with 20-100 nm in width and 10-30 nm height were formed on DLC coating due to the residual stress and difference in Young's modulus [1-3].

Nanoscale roughness effect on tribological behaviors was observed by performing a tribo-experiment by 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 were measured with respect to thickness change of coated DLC thin film on PDMS. It was found that with increase the thickness of DLC coating on PDMS, the COF (coefficient of friction) decreased by comparison to the uncoated PDMS. The wear tracks after friction test were observed by SEM and AFM.

References

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