

Tribochemical formation of diamond-like carbon films on catalytically-active noble alloys

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Abstract

Low shear strength organic films were grown in-situ on platinum-gold thin films via cyclic sliding contact in dry nitrogen with trace concentrations of ambient hydrocarbons. Steady-state friction coefficients were found to be as low as $\mu \approx 0.015$ and inversely proportional to contact pressure, revealing non-Amontonian behavior. At contact pressures above 500 MPa, shear strength dropped, indicating an activated process. The regions of steady-state low friction behavior exhibited spectra similar to diamond-like carbon coatings. Raman spectroscopy identified non-uniformity in areal coverage and relative order with contact pressure. Atomic force microscopy was used to study the formation and growth of these films at the nanoscale; stress- and time-dependent measurements suggested a sublinear increase of film volume with time, and a transition from growth to wear at a contact pressure of 1.2 GPa. SNL is managed and operated by NTESS under DOE NNSA contract DE-NA0003525.

Keywords

diamond-like carbon, low friction, tribochemistry, self-lubricating, Hertzian contact