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In-Situ Tribochemical Formation of Self-Lubricating DLC Films

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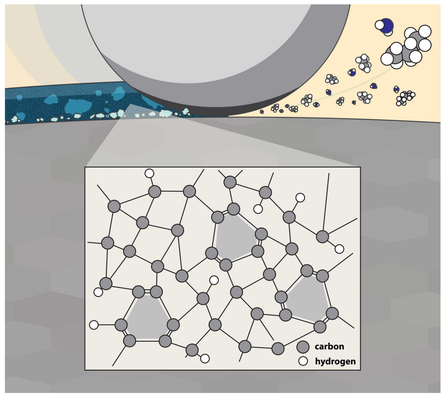
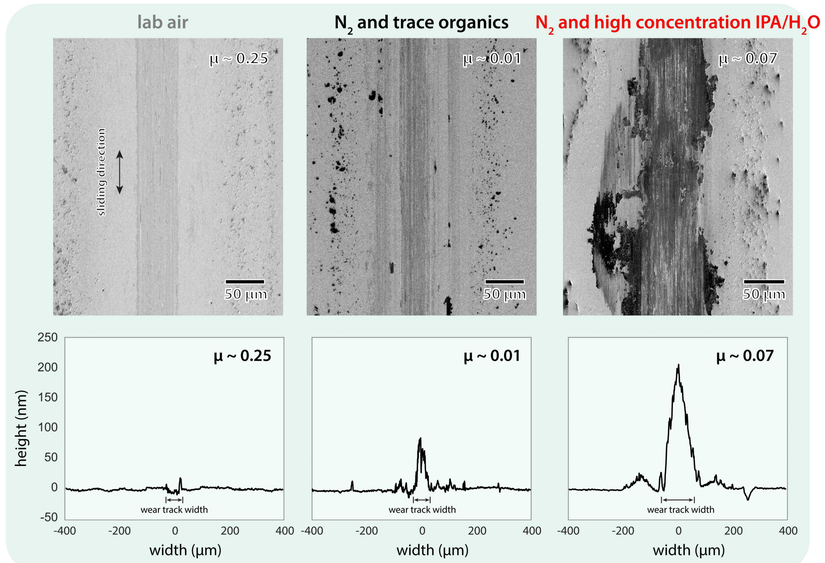
Abstract

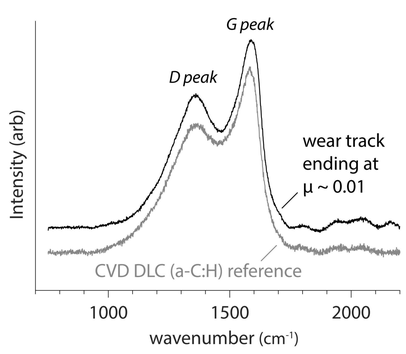
Diamond-like carbon (DLC) films were tribochemically formed from ambient hydrocarbons on the surface of a nanocrystalline Pt-Au alloy. A sliding contact between an alumina sphere and Pt-Au coated steel exhibited friction coefficients as low as μ = 0.01 after dry sliding in environments containing trace (ppb) organics. Ex situ analysis indicated formation of amorphous carbon films, and Raman spectroscopy and elastic recoil analysis showed that these films consist of sp^2/sp^3 amorphous carbon with as much as 20% hydrogen. Transmission electron microscopy indicated these films had thicknesses exceeding 100 nm, with incorporated worn Pt-Au nanoparticles.

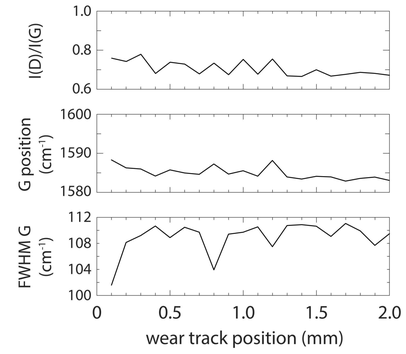


Generated DLC Transfer Films

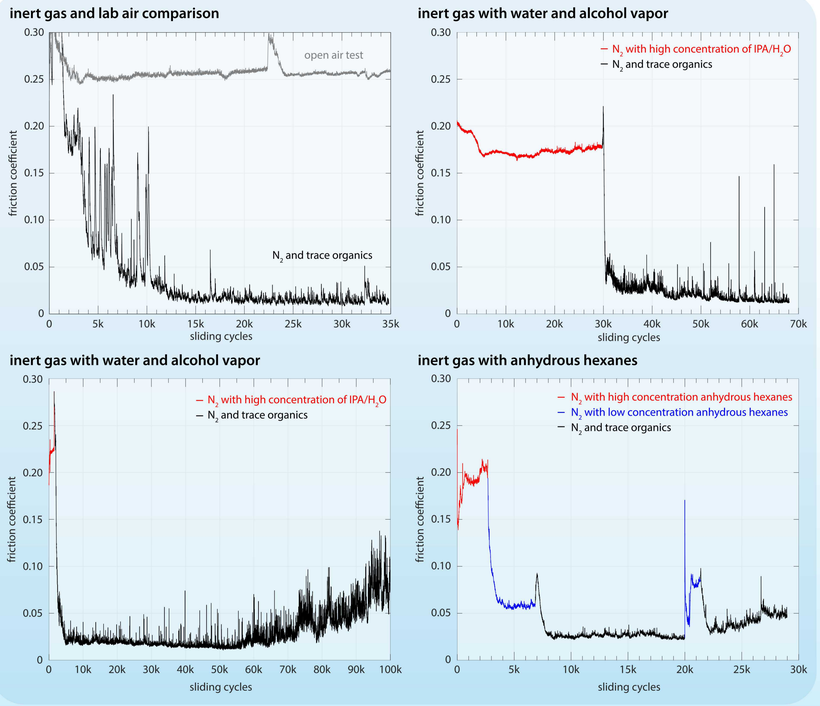


Raman in Wear Track

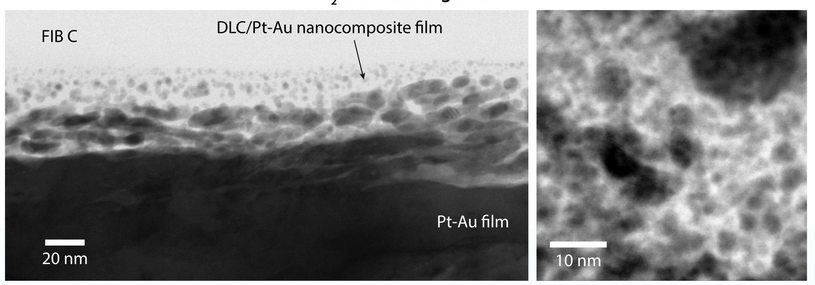




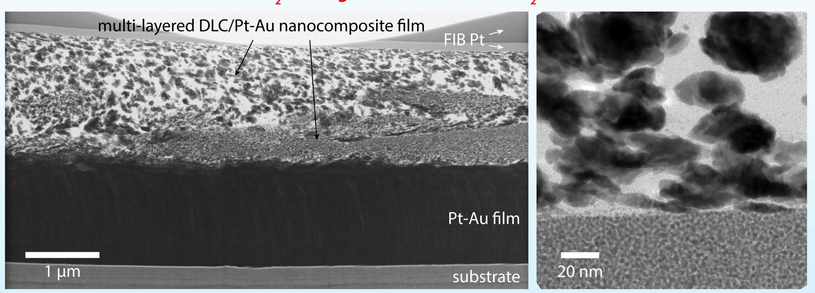
Role of Ambient Organics in Pt-Au Friction



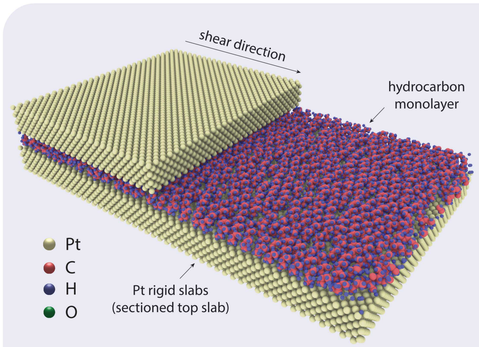
N_2 and trace organics

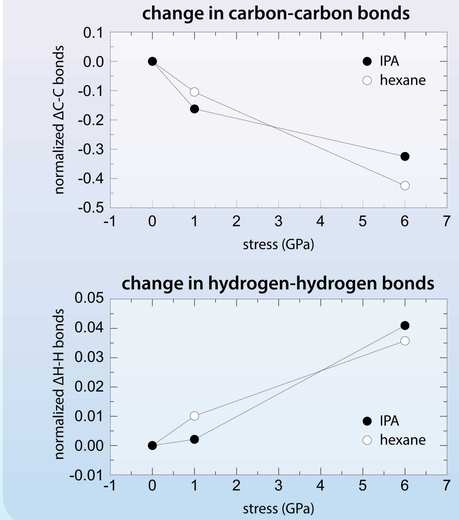


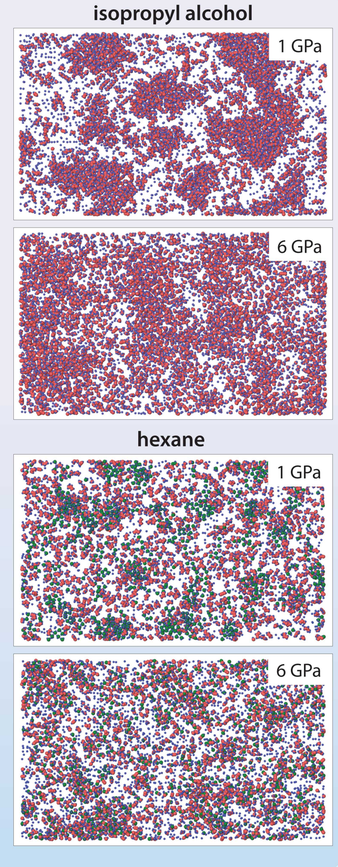
N_2 and high concentration IPA/H_2O



MD Chain Scission Simulations







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