Abstract Submitted
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QCM and AFM Study of atomic scale polishing and roughening of surfaces exposed to nanoparticle suspensions of diamond, Al_2O_3 and SiO_2.[1] JACQUELINE KRIM, BIPLAV ACHARYA, MELANIE CHESTNUT, ANTONIN MAREK, NCSU, OLGA SHENDAROVA, Admas Nanotechnologies, Inc, ALEX SMIRNOV, NCSU — The addition of nanoparticles to conventional automotive lubricants is known in many cases to result in increased energy efficiency, but the atomic scale mechanisms leading to the increased efficiency are yet to be established. To explore this issue, we studied surface uptake and nanotribological properties of nanoparticle suspensions of diamond, Al_2O_3 and SiO_2 dispersed in water and/or oil (PAO6) in real time by means of an *in situ* Quartz Crystal Microbalance (QCM) technique, with a focus on the impact of the suspension on the surface roughness and texture of the QCM electrode and how the results compared to macroscopic reductions in friction and increased energy efficiency for the same materials' combinations. The frequency and dissipative properties (mechanical resistance) of QCM's with both gold and nickel surface electrodes were first studied for immersed samples upon addition of the nanoparticles. Nanodiamonds resulted in an increased mechanical resistance while the addition of Al_2O_3 and SiO_2 nanoparticles resulted in a decreased resistance, indicating a reduced resistance of the fluid to the motion of the QCM. Atomic Force Microscope (AFM) measurements were then performed on the QCM electrodes after exposure to the suspensions, to explore potential polishing and/or roughening effects. The results are closely linked to the macroscopic friction and wear attributes.

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Jacqueline Krim
NCSU

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