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Tribological Properties of Nanodiamonds in Aqueous Suspensions: Effect of the Surface Charge.[1] J. KRIM, ZIJIAN LIU, D.A. LEININGER, A. KOOVILAND, A.I. SMIRNOV, North Carolina State University, O. SHENDAROVA, International Technology Center, Raleigh, NC, D.W. BRENNER, North Carolina State University — The presence of granular nanoparticulates, be they wear particles created naturally by frictional rubbing at a geological fault line or products introduced as lubricant additives, can dramatically alter friction at solid-liquid interfaces. Given the complexity of such systems, understanding system properties at a fundamental level is particularly challenging. The Quartz Crystal Microbalance (QCM) is an ideal tool for studies of material-liquid-nanoparticulate interfaces. We have employed it here to study the uptake and nanotribological properties of positively and negatively charged 5-15 nm diameter nanodiamonds dispersed in water[1] in the both the presence and absence of a macroscopic contact with the QCM electrode. The nanodiamonds were found to impact tribological performance at both nanometer and macroscopic scales. The tribological effects were highly sensitive to the sign of the charge: negatively (positively) charged particles were more weakly (strongly) bound and reduced (increased) frictional drag at the solid-liquid interface. For the macroscopic contacts, negatively charged nanodiamonds appeared to be displaced from the contact, while the positively charged ones were not. Overall, the negatively charged nanodiamonds were more stable in an aqueous dispersion for extended time periods.

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