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Friction and Stability of Carbon Onions Films in Vacuum R.A. AL-DUHAILEB, Michigan State University, B.W. JACOBS, Sandia National Laboratories, CA, M.A. CRIMP, V.M. AYRES, Michigan State University, A. HIRATA, M. HORIKOSHI, Tokyo Institute of Technology, Japan, M.G.I. GALINATO, N. LEHNERT, University of Michigan — Planar graphite is a state-of-the-art low friction solid lubricant. However, in vacuum environments, graphite-based solid lubricants require potentially harmful heavy metal additives to maintain tribological performance. Recent experiments by our group indicate that carbon onions show excellent tribological performance ($\sim$0.03 friction coefficient) without the addition of heavy metal additives. They are therefore good candidates for environmentally benign solid lubricants for use in vacuum. Carbon onion film stability to prevent exposure of un-lubricated surfaces is also an important issue. Tribological performance assessed using ball-on-disk friction measurements equivalent to a 10 m sliding distance indicated that a 15 wt.% solution at 80 $^\circ$C peroxide oxidation treatment improved the film stability. In the present work, carbon onion friction and film stability are correlated with fundamental structural and chemical properties investigated by high-resolution transmission electron microscopy (HRTEM), electron energy loss spectroscopy (EELS) and multi-wavelength micro-Raman spectroscopy at 77K.

Virginia Ayres
Michigan State Unversity

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