Lunar dust adhesion testing for evaluation of passive adhesion-mitigating polymer coatings

Brad M. Atkins,[1*] John W. Connell,[2,] and Christopher J. Wohl[2]
[1]*Physics Department, Rhodes College, Memphis, TN 38112*
[2] *Advanced Materials and Processing Branch, NASA Langley Research Center, Hampton VA 23681*
Brad.M.Atkins@gmail.com

A library of low surface energy copoly(imide siloxane) films has been generated within the Advanced Materials and Processing Branch at NASA LaRC for application as protective coatings that offer intrinsic adhesion resistance to lunar dust. The reduction in surface energy was verified using contact angle goniometry. A vacuum adhesion testing chamber has been constructed housing sonication and optical particle counting equipment to evaluate the impact of reducing a material's surface energy on adhesive interactions with lunar simulant. To simulate the presence of high lunar surface potentials and electric fields the chamber is currently being outfitted with a High Voltage capacitor device that will surround prospective coatings during sonication adhesion testing. Preliminary theoretical modeling of electric field induced adhesion interactions between the dielectric coatings and lunar simulant based on analog xerographic dielectric toner particles deposited on dielectric planar surfaces indicate induced adhesion is possible for electric fields on the kV/m for initially uncharged simulant. Experimental verification underway to test this prediction and to determine the accuracy of contact angle screening is aimed at yielding effective protective lunar dust adhesion mitigating coatings for astronauts, equipment and habitats of future lunar surface missions.

[*] Attending Graduate School beginning fall semester 2010 at:
Aerospace and Ocean Engineering Department, Virginia Tech, Blacksburg, VA 24061