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EFFECTS OF ULTRAVIOLET (UV) IRRADIATION ON LUNAR REGOLITH ELECTROSTATICS

Abstract

Lunar regolith, which is easily disturbed, and stays dispersed can be a major obstacle to lunar exploration due to its high abrasive and adhesion behavior. This unfavorable combination of properties can cause major damage to sensitive machine parts, electronic circuits and optical instruments over time. This can lead to prohibitive maintenance, repair, and operation (MRO) costs. A significant component of the regolith's adhesiveness comes from electrostatic forces between the particles. Understanding the charging mechanisms and the characteristics of charged regolith is pivotal for predicting its dispersion and adhesion to other materials. We investigate one of the factors that cause electrostatic charge accumulation in regolith aggregates - exposure to UV rays. Existing literature indicates that regolith exposed to 174nm UV for 30 minutes in a vacuum will level as it is hypothesized that grains rearrange to fill cavities to satisfy their induced polarity. The current study observes the effects UV radiation on regolith simulants, Lunar Highlands , Lunar Mar, and Lunar South Polland, additionally their respective lunar dust variants, at both the micro and macro scale. The macro scale is defined as the millimeter variance in the regolith sample's terrain. And the micro level is the micron size cavity between grains. A combinatoric variable sweep of UV wavelengths, regolith temperature and motion, along with regolith grain size is planned. These studies would reveal the effect of UV light on charge, clumping and arrangement patterns. These findings can then be used to quantify the potential effect of UV light on lunar dust adhesion enhancing our design envelope of lunar dust mitigation strategies.