

Passive Dust Mitigating Materials Evaluation Supporting NASA's Patch Plate Materials Compatibility Assessment Project

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Introduction: Lunar dust is one of the main challenges for long term exploration and habitation on the lunar surface. Exposure to this jagged, abrasive, electrostatic and highly adhesive dust will lead to contamination and failure of components, from radiators and solar arrays to spacesuits and interlocks. With the Artemis mission planning to send humans to the moon potentially in 2024, there is an urgent need to develop methods to mitigate the effects of lunar dust to enable mission success. An important strategy is passive dust mitigation, in which the material surface itself can reduce dust adhesion. This may be an intrinsic property of the material or might be imparted by surface modification such as a coating, topographical modification, or both. The Patch Plate Materials Compatibility Assessment Project under the Space Technology Mission Directorate's Dust Mitigation Program aims to develop passive dust mitigating materials technologies, demonstrate their performance in ground-based tests simulating the lunar environment, and finally fly them to the lunar surface for actual evaluation. For the Patch Plate task at NASA Langley Research Center (LaRC), a variety of materials and surfaces were examined for lunar dust simulant adhesion using a custom-built adhesion testing system. Some of these materials had extensive space-heritage, while others were novel and fabricated in house. Laser patterning was also evaluated as an approach to controllably alter the topography. Evaluation of a broad array of potentially useful materials and surface modified materials will be performed followed by down selecting the materials and surfaces that exhibited promising dust adhesion mitigation performance. A brief overview of the dust adhesion test results and other characterization conducted for the different classes of materials for passive dust mitigation will be discussed.