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Electrostatic Cleaning System Integrated with Thunderon Brush for Lunar Dust Mitigation

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Abstract : Detrimental effects of lunar dust on space hardware, spacesuits, and astronauts' health have been already identified during Apollo missions. Developing effective dust mitigation technologies is critically important for successful space exploration and related missions in NASA applications. In this study, an electrostatic cleaning system (ECS) integrated with a negatively ionized Thunderon brush was developed to mitigate small-sized lunar dust particles with diameters ranging from 0.04 µm to 35 µm, and the mean and median size of 7 µm and 5 µm, respectively. It was found that the frequency pulses of the negative ion generator caused particles to stick to the Thunderon bristles and repel between the pulses. The brush was used manually to ensure that particles were removed from areas where the ECS failed to mitigate the lunar simulant. The acquired data demonstrated that the developed system removed over 91-96% of the lunar dust particles. The present study was performed as a proof-of-concept to enhance the cleaning performance of ECSs by integrating a brushing process. Suggestions were made to further improve the performance of the developed technology through future research.

Keywords : lunar dust mitigation, electrostatic cleaning system, Brushing, Thunderon brush, cleaning rate
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