Studying Passive Dust Mitigation on Anisotropic Structured Surface

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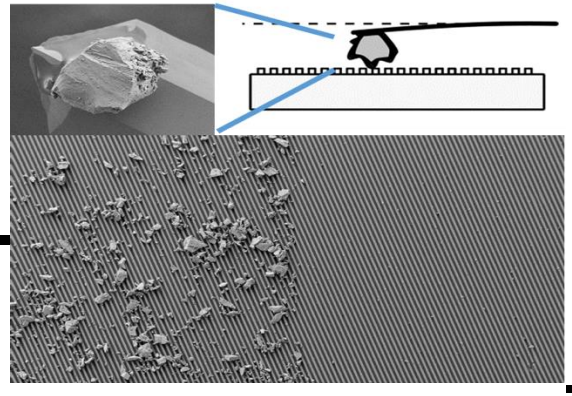
Research Objectives

- **The objective of the research is to tackle the challenges of SOA** including precise control of surface texture features, electrical conductivity and hardness for effective dust mitigation, and the study of dust-dust and dust-surface interactions under simulated lunar environment.
- **Simulate** the dynamics of lunar dust, dust-dust interactions and dust-surface interactions.
- **Develop** thermoplastic polyurethane (TPU) coatings with controlled texture, electric conductivity and surface hardness for passive lunar dust mitigation.
- **Develop** AFM based dust-dust and dust-surface interaction characterization technology in simulated lunar environment.
- **Demonstrate** passive dust mitigation of TPU in simulated lunar environment.
- **Starting TRL**: (1) **Ending TRL**: (3)



Regolith will be attached on AFM tips to study the grain-grain interactions and the interaction of grain and proposed coatings

Approach

- Thermoplastic polyurethane (TPU) coatings with controlled surface texture' conductivities and surface hardness will be fabricated to ***investigate the impact of surface properties on the interactions between dust and surfaces and realize passive dust mitigation***.
- We will simulate electrostatic forces and tribocharging of lunar dusts and the dynamics of irregular shaped dust to understand the interactions between dusts and textured surface and evaluate the effectiveness of the proposed mitigation strategy.
- We will characterize surfaces and dust adhesion via a unique suite of diagnostics and measurement techniques, including measurements at the grain-scale via atomic force spectroscopy (AFM) and bulk (centrifuge) measurement under simulated lunar environment.
- We will demonstrate passive dust mitigation in high vacuum and evaluate the efficiency of the system using centrifugation.

Potential Impact

- TPU Surfaces can be coupled to provide ***improved dust mitigation* on a *wide range of subsurface materials.*** AFM technology to evaluate interactions in vacuum can be used to monitor structure change of interested systems in space.
- Impact: Addresses Passive Lunar Dust Control through Advanced Materials and Surface Engineering
- **Potential applications**:
  - Overlay for surfaces for rovers, solar panels, suits
  - Surface characterization of materials under simulated space environment.
  - Conductive TPU overlays can be coupled with e.g. electrodynamic dust shield (EDS) techniques to further improve mitigation
- Partners include NASA, especially KSC with EDS.