Dust Cleaning, Transportation And Sampling In Lunar Environment Using Traveling Electric Field

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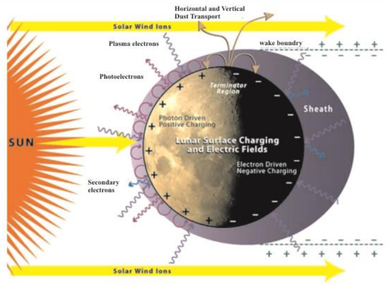
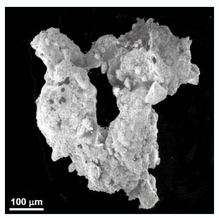
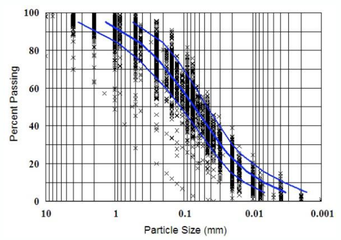


Lunar dust **is electrically charged**

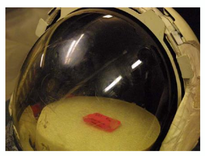




(courtesy of NASA)

It is very **fine** and **highly abrasive** with **irregular shape** and **sharp edges**

P. Conrad's worn suit



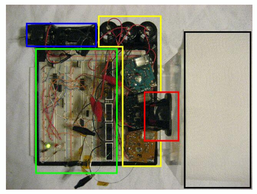
H. Schmitt's scratched visor sunshade

LRV wheel covered with dust

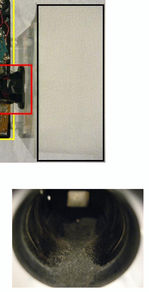
LRV batteries covered with dust

(courtesy of NASA)

Lunar dust caused major problems during Apollo missions



(Before)



(After)

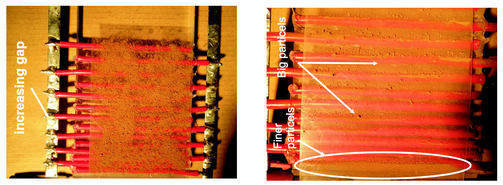
DC activated device works with 12V DC power supply

$V_{applied}$ = 1580V, ν = 100 Hz, $D_{electrode}$ = 4.03 mm, gap = 9 mm

(Before)

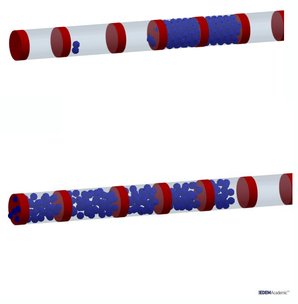
(After)

AC activated device



Planar device with linearly increasing gap , for **sorting** and **separating** particles

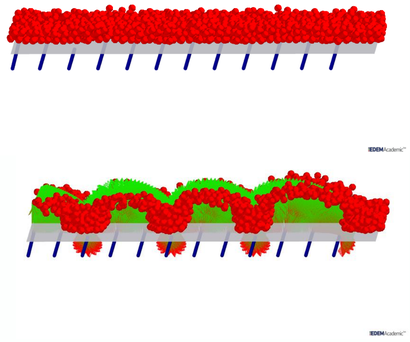
$V_{applied}$ = 1580V, ν = 100 Hz, $D_{electrode}$ = 4.03 mm



Dust **sampling**, and **transportation**

Cylindrical device, before and after activation of the device

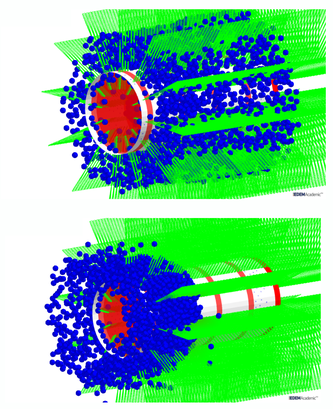
$V_{applied}$ = 900V, ν = 50 Hz, $D_{electrode}$ = 50 µm, gap = 400 µm



Cleaning dust covered **solar panels**, and **optical sensors**

Planar device, before and after activation of the device

$V_{applied}$ = 900V, ν = 50 Hz, $D_{electrode}$ = 50 µm, gap = 400 µm



Cleaning dust covered the **bearings**

Cylindrical device, before and after activation of the device

$V_{applied}$ = 900V, ν = 50 Hz, $D_{electrode}$ = 50 µm, gap = 400 µm

Summary

The main advantages of using electrostatic and dielectrophoretic forces to clean surfaces and transport samples are:

- It transport both **charged** and **uncharged** particles.
- It **lifts** the particles and reduce the potential of scratching the surface
- It needs **low power**.
- Cleaning efficiency for particles smaller than 212 µm is **above 90%.**
- It can be incorporated into a **transparent** and **flexible** screens to protect optical sensors.

Acknowledgments

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