Dust Transport on a Surface in Plasma

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Dust on the lunar surface exposed to UV radiation and solar wind plasma could get charged and thus transports electrostatically. We investigate dust transport on the surface in laboratory plasma generated by a negatively biased hot filament. JSC-Mars-1 dust simulants with radii less than 25 microns are used in the experiments. When the plate bias is more negative than its floating potential, an initial dust pile spreads and forms a dust ‘ring’, (Fig. 1). The dust particles are also observed to spread over an insulator, indicating that a ‘hopping’ mechanism is involved. Horizontal potential distributions above the dusty plate show an outward electric field near the dust/plate boundary, which pushes dust particles to spread on the surface. A non-monotonic potential dip is observed in the sheath above the dust layer, which results in an upward electric field near the dust layer against the gravity. The dust particles could be thus lifted off the surface and hop to the surrounding area. When the radius of the spreading dust layer becomes comparable to the sheath thickness of the plate, it is found that the electric field and charge of the dust particles vary in the radial direction due to the radial variation of the sheath structure. These variations during the dust spreading result in a dust ‘ring’ formation at the end.

Fig.1 Images of three phases of dust spreading at 1 min, 20 min and 45 min after the plasma is turned on.