

Particle Charging at Simulated Martian Conditions

The mechanism for aolian transport of sand particles on Mars is still subject to some debate. It has been proposed that *reptation*, the ballistic injection of grains by impact of saltating grains and by nudging of surface grains into a creeping motion, is the prime mechanism of dust transport on Mars. During saltation, grains lifted into the atmosphere travel over a distance and land again on the surface (Fig. 1). Upon impact with the surface, the grains either bounce back into the atmosphere, roll, or kick out other particles. The entire frictional process whereby particles slide, roll, and impact themselves and on other objects can lead to contact electrification. This phenomenon may be enhanced by the high frequency of dust devils, which were observed by the Pathfinder mission to occur daily. The choice of materials for future Mars missions needs to reflect a due consideration of the magnitude of the charge that these materials can acquire by moving airborne Martian dust particles.

To simulate the saltation effect, an apparatus was devised to drop Martian simulant grains down a deflection board whose surfaces were coated with either Rulon[®], Lexan[®], Teflon[®], Fiberglass-Epoxy G-10, Acrylic, and Acetate (Fig.2). These experiments were performed in a 9-millibar atmosphere to simulate the average pressure on the surface of Mars. The particles, under the force of gravity, bounced, rolled, slid, and were finally deflected until falling into a Faraday cup for charge measurement. It has been speculated that corona fields can affect the electrostatic charging of the simulant grains. To study this phenomenon, the particles were allowed to fall through either an AC, +DC, or -DC corona field. In all cases, the simulant is dropped directly through the field before bouncing down the deflection board. Background runs with no corona fields were obtained for benchmark.

Figure 3 shows the percent change in simulant charging over no corona for the three corona cases. Further experiments will look at the corona fields effect on neutralized simulant and will compare the magnitude of the simulant electrification at extremely low humidity values.

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FIGURE 1

Figure 1. Saltation. Sand particles lifted into the atmosphere travel over a distance and land again on the surface.

FIGURE 2

Figure 2. Deflection board assembly.

FIGURE 3

Figure 3. Percent change in charging over no corona for various corona cases.