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SALTATION THRESHOLD DETECTION IN A WIND TUNNEL BY THE MEASUREMENT OF THE NET ELECTROSTATIC CHARGE

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MARSWIT (Mars Surface Wind Tunnel) is an open circuit wind tunnel used for aeolian studies and is located inside a large vacuum chamber allowing testing at martian surface atmosphere pressure (Greeley et al., 1977). Since direct access is not available to the tunnel during operation at low pressure a remote method of saltation detection is needed. The bed is observed by means of closed circuit video, but it is often difficult to determine the initiation of threshold. The measurement by means of an electrometer of the net electric charge produced by the saltating particles has provided a reliable means of saltation threshold detection.

Saltating particles become charged several ways, both in wind tunnels and in a natural environment. The most significant of these methods are tribo-charging and contact charging, which always occur. Fracture charging may also occur under the high velocities associated with particle transport on Mars or under simulated martian conditions.

The method of detection used in MARSWIT is by allowing the saltating particles to impinge on a planar conducting surface normal to the flow that is connected to ground through a Keithly Electrometer. The signal from the electrometer is connected to a strip chart recorder along with the analog signal from the pitot tube transducer that is used to determine the wind velocity in the tunnel. Thus a record of wind velocity and the initiation of particle saltation is conveniently displayed together.

While both positive and negative charges are produced during saltation this method measures only the net charge and thus may be either positive or negative depending upon the particles being tested, the size and size distribution of the test material and the wind velocity.

This has proved to be a very trustworthy and sensitive method of saltation threshold detection, being especially useful with the smaller sized particles which are the most difficult to observe visually.

References: Greeley, R. et al. 1977. NASA TM 78423, 2a p.