ELECTROSTATIC ADHESION OF LUNAR SOIL PARTICLES ILLUSTRATING NON-GRAVITATIONAL GROWTH OF SMALL BODIES IN SPACE; G. Arrhenius and S. K. Asunmaa, Scripps Institution of Oceanography, University of California, San Diego, La Jolla, California 92037.

Non-gravitational forces (electrostatic, magnetic, chemical) are of importance for understanding the beginning growth of bodies in space. They also provide an explanation for the observation of dust coating on small asteroids. The lunar soil provides the first material where the effect of such forces in the space environment can be studied experimentally.

Besides thermal welding, electrostatic forces are found to be most important. Using corpuscular irradiation effects as criteria, we show that the characteristically strong adhesion is caused by irradiation induced surface layer modification of one or both of the interacting grains.

We have developed instrumentation for measuring the forces by which lunar soil particles in the size range below the order of 100 μm adhere to larger, individually selected host grains. The adhering particles are removed by a laminar flow of dry argon with controlled speed. The particles, detached by gas shear, are collected in an area of about 1 mm^2 in successive portions after stepwise increase in gas flow velocity. They are analyzed for size and composition by electron microscopy and electron diffraction.

Adhesive forces in the major fraction of grains range between the order of 10 dynes and 100-200 dynes. A small fraction of particles show still higher adhesion - structural inhomogeneities in the surface of the host grains form sites of exceptional electrostatic adhesion strength.

Host grains of feldspar, olivine, pyroxene, ilmenite and glass were analyzed separately and show systematic differences. Irradiated pyroxene host grains generally develop the strongest interaction with adhering microparticles, olivine and ilmenite the lowest.

The persistence of electrostatic grain coating with depth in lunar soil cores suggests that the decay of the radiation induced electrostatic attraction has an e^{-1}-folding time of the order of at least 10^6 years.

The observations are discussed in terms of the internal velocity evolution of orbiting primordial grain assemblages, and the limiting relative velocities that need to be achieved before electrostatic accretion can contribute to the growth of planetesimals.