

FINES PHOTOCONDUCTIVITY. Román Alvarez, Instituto de Geofísica, UNAM, México 20, D.F.

Photoelectric phenomena are known to occur at the lunar surface under solar irradiation (1). Evaluation of such effects on the electrical properties of surface rocks has been very limited (2); yet, the results available indicate that surface conductivity of solid samples may be increased five or more orders of magnitude by solar photon bombardment. The present report suggests that conductivity increments in fines surface conductivity may be even more important. These results are of direct relevance to levitation and transport phenomena on the lunar surface.

A sample of terrestrial basalt simulating Apollo 12 fines and described in (3) was used prior to measurement of actual lunar samples in order to calibrate the experiment; results on the latter samples shall be presented subsequently. The simulator was irradiated with visible, infrared (IR), and ultraviolet (UV) sources of 235 and 365 nm wavelength; further experimental details were described in (2). Measurements were made in a vacuum of  $2.0 \times 10^{-9}$  torr at  $295^\circ\text{K}$  and of  $1.6 \times 10^{-8}$  torr at  $100^\circ\text{K}$ . The surface exposed to irradiation was of  $3.52 \text{ cm}^2$ ; conductivity changes were measured in a 1 mm thickness layer, although the overall sample thickness was of 7.6 mm. Voltage applied between measuring electrodes was of 500 volts.

The response of surface conductivity to UV (235 and 365 nm) irradiation is shown in Figure 1. Comparing this response of fines with the corresponding responses of lunar and terrestrial solid samples (2), it becomes apparent that the response in the powder does not sustain the initial (two orders of magnitude) jump in conductivity, whereas the solid samples do sustain it. The differences in response are believed to originate in the different aggregation state (i.e. granular or solid) rather than in the different composition of the powder (basalt) and of the solid lunar sample 15498 (basalt, plagioclase, pyroxenes, etc.), however no definitive statement can presently be made in this respect.

Figure 2 shows the response of the powdered sample to visible, infrared and ultraviolet sources. When all sources (VIS, IR, UV) were on for a period of 10 minutes, a surface conductivity change of seven orders of magnitude was induced in the sample. This result contrasts with the response of solid sample 15498 which varied five orders of magnitude in 22 minutes under the same irradiation conditions (2). An additional difference between the response of solid and powdered samples seems to be the apparent dominance of visible light in the surface conductivity of the solid sample, while infrared seems to dominate the changes in the powdered sample. Straight lines in the plot of Figure 2 which can also be described by the relation  $\sigma = \sigma_0 e^{-t/\tau}$ , as it was (2) for the solid samples. The electrical conductivity is  $\sigma$ ,  $t$  is the time and  $\tau$  is the response time of the photoconductive process. Table 1 summarizes the results for the lights-on period ( $+\tau$ ) and the lights-off period ( $-\tau$ ). With

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the exception of the response for visible, plus infrared, plus ultraviolet (Figure 2) all responses show two straight lines during the excitation or de-excitation periods; two relaxation times would involve two species of charge carriers with different mobilities. Notice that for the case of the infrared response both at 100° and 295°K, we have not defined the corresponding  $+\tau$  since there is some ambiguity in the definition of the second straight portion.

T A B L E 1

RADIATION	ON		OFF
	TEMP (°K)	$+\tau$ (sec)	$-\tau$ (sec)
VIS + IR + UV (235 + 365)	295	25	42
VIS	295	15,73	8,90
VIS	100	27,115	10,47
IR	295	10, ?	46,56
IR	100	13, ?	50

## REFERENCES

- (1) Goldstein, B.E., Observations of electrons at the lunar surface. J. Geophys. Res., 79, 23-35, 1974.
- (2) Alvarez, R., Lunar and terrestrial sample photoconductivity, Proc. Lunar Sci. Conf. 6th, 3187-3197, Pergamon, New York, 1975
- (3) Alvarez, R., Lunar powder simulator under lunarlike conditions dielectric properties, J. Geophys. Res., 78, 6833-6844, 1973

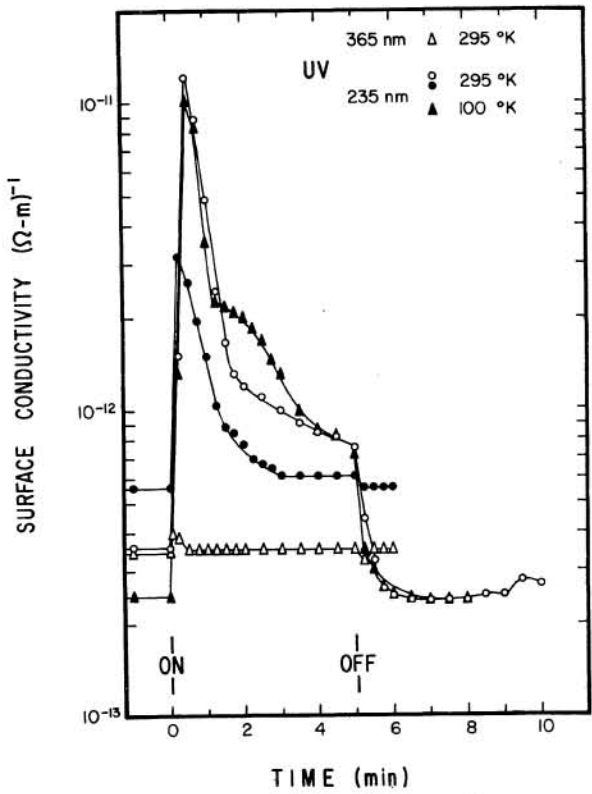


Fig.1. Surface conductivity showing photoelectric response to UV excitation of terrestrial basalt simulating lunar fines.

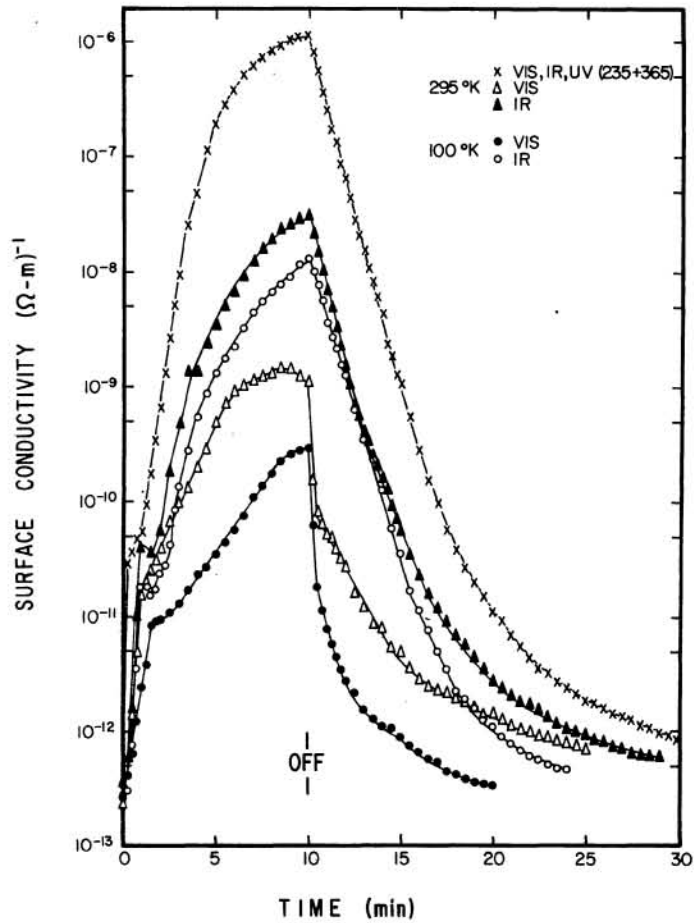


Fig.2. Surface conductivity showing photoelectric response to visible, infrared and ultra-violet sources.

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