Langmuir probe measurements of photoelectron plasmas above insulating surfaces

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Abstract. In previous work, we have presented the results of photoelectron sheath profile measurements above a conducting Zr surface[1]. Because we are interested in studying the near-surface environment of the Moon and other airless bodies in space, however, insulating surfaces are more relevant. Insulating surfaces make interpretations of measurements much more complex due to complicated potential structures and varied surface properties. Here, we present measurements taken above insulating surfaces with varied yields and determine the photoemissive properties of the surfaces, as well as the characteristics of the emitted electron populations. Photoemission is created by ~32 W UV illumination from Xe-excimer lamps, with a narrow peak of emission at 172 nm (7.21 eV), placed inside the vacuum chamber. Measurements are taken at vacuum pressure of a few 10^{-6} Torr with a single-sided planar Langmuir probe placed at varying heights above the photoemitting surfaces. Electron energy distributions, densities, and temperatures and plasma potentials are derived from these measurements.

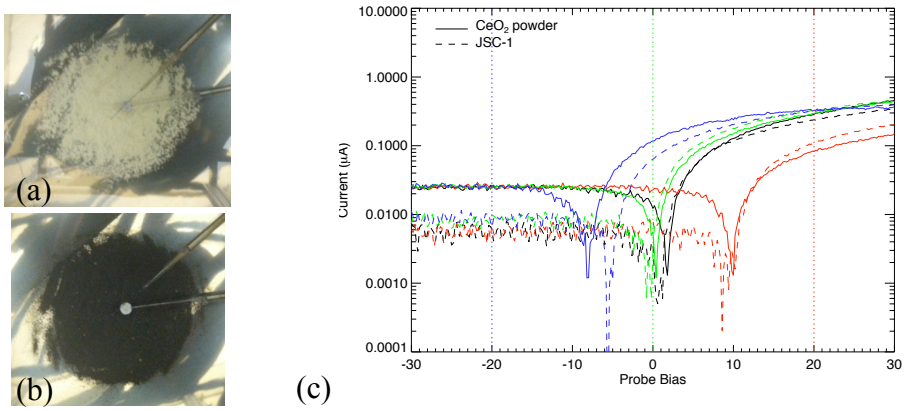

Figure 1. Measurements are taken above (a) CeO2 powder and (b) un-sieved JSC-1 on Zr, when the Zr is biased to different voltages. (c) Langmuir probe sweeps above the two surfaces with the Zr biased to -20 V (blue), 0 V (green), +20 V (red), and electrically floating (black)

[1] Dove, A. *et al.*, *Phys. Pl.*, 19 (2012)