SPACE EXPLORATION SYMPOSIUM (A3)
Moon Exploration – Part 2 (2B)

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CRYOGENIC MICROSCOPIC ASSESSMENT OF LUNAR AND PLANETARY ICY REGOLITH ANALOGUES

Abstract

Significant amounts of icy regolith make up soils and permanently shadowed craters on lunar and planetary surfaces. Ice-rock mixtures are also present within the outer layers of comets, asteroids and in planetary rings. With current technologies, it is now even possible to explore the surfaces of comets (e.g. the Rosetta mission) and that therefore makes studies of icy regoliths timely. The analysis of ice-rock mixtures at a microscopic level is crucial for determining the mechanical properties of icy regoliths and for the study of meteoroid and dust bombardment into regolith. Well-parametrised icy regolith analogues are necessary for testing future space mission instruments designed to land, impact, excavate and/or sample icy regoliths. There have been very few high fidelity ice-rock regolith simulations to date. However, none of them were able to constrain parameters for ice grain size and particle mixing. In this study, the techniques for preparing such icy regolith analogues are reported with constraints on ice/particle size and ice-particle mixing. Optical microscopy and a cryogenic SEM were used to prepare and assess the textures of simulated icy regolith. Three different regolith analogues were prepared, which simulated a variety of lunar/planetary surfaces. Fly ash was used for the first time as a lunar/planetary regolith analogue material. Furthermore, cryogenic SEM analyses enabled the ice-regolith sample assessment in conditions typical for numerous lunar and planetary surfaces (in a vacuum at 103-173 K).