

Laboratory experiments to investigate sublimation rates of water ice in nighttime lunar regolith

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The existence of water ice on the lunar surface has been a long-standing topic with implications for both lunar science and in-situ resource utilization (ISRU). Cold traps on the lunar surface may have conditions necessary to retain water ice, but no terrestrial experiments have been conducted to verify modeling results. In order to assess the efficiency of retaining water ice in cold traps, an experiment was conducted to measure the sublimation rate of water ice embedded in a cold lunar regolith simulant. The simulant used in the experiment was JSC-1A lunar regolith simulant developed by NASA's Johnson Space Center. Samples with varying ratios of water ice and JSC-1A regolith simulant were placed under vacuum and cooled to 100 °K to simulate the conditions of lunar cold traps. The resulting sublimation of water ice over an approximately five-day period was measured by comparing the mass of the samples before and after the experimental run. Our results indicate that water ice in lunar cold traps is stable on timescales comparable to the lunar night, and should continue to be studied as possible resources for future utilization. This experiment also gauges the efficacy of the synthetic lunar atmosphere mission (SLAM) as a low-cost water resupply mission to lunar outposts.