# Generating a more analogous lunar regolith simulant in order to better understand reactivity and potential toxicity

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**Abstract**. Lunar activities by humans such as mining, exploration, energy production, etc. will become more commonplace in time. However, exposure to lunar dust in large quantities during such activities, has been confirmed as being potentially hazardous. Previous work on assessing potential toxicity has involved evaluation of the reactivity of various mineral phases present in lunar dusts including olivine, plagioclase, pyroxene, and quartz (control mineral). This work indicated that mafic silicates generate the most reactive oxygen species (ROS) such as hydroxyl radicals (OH*) and hydrogen peroxide ($H_2O_2$).[1,2] The results imply that highly reactive iron-rich mineral phases may be the most hazardous to human health. Lunar regolith simulants such as JSC-1A, NU-LHT-2M, and CSM-CL have been assessed for both reactivity and toxicity.[3-5] Similar trends appear in relation to the dependence of silicate-FeO content and reactivity but no discernable relationship exists between toxicity and reactivity. The simulants used often contain some amount of hydrous mineral and oxidized mineral phases which are absent on the lunar surface.[6] They are generally deficient in metallic iron which may have a strong effect on toxicity. In order to overcome the problems of oxidized and hydrated phases, we have employed a simple reduction experiment similar to the one performed by [7] in order to reduce the materials used for toxicity studies. Approximately 3 g of lunar regolith simulant JSC-1A was heated under a stream of hydrogen gas at 900 ºC in a glass tube for 15 min. This produced metallic iron seen as blebs on the surfaces of grains. Since toxicity and reactivity experiments involve destructive techniques, this material is well suited for the work described in this summary. Three separate aliquots (200 mg each) from three separate batches of both reduced and non-reduced JSC-1A were ground by hand in a mortar and pestle for 10 min. Samples were then incubated in 0.5 mL of the spin-trap compound known as DMPO for 15 min. The resulting slurries were filtered using a 0.2 µm syringe filter; then the filtrates were placed into a 50 µL glass capillary tube. The tubes were in turn, placed into an electron paramagnetic resonance (EPR) spectrometer to measure the amount of OH* generated by the samples. Our results show that our methodology in reducing JSC-1A has a significant impact on its reactivity. Preliminary data also indicate that cell toxicity levels were also significantly higher using the reduced rather than original JSC-1A. The large difference observed in reactivity are consistent with the observations made in [8] in which JSC-1A was significantly less reactive relative to various tested Apollo soils.

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