PROCESSING OF LUNAR SIMULANT BY PARTIAL OXIDATION AND MAGMA ELECTROLYSIS.

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Exploratory development work was performed to examine the feasibility of extraction of oxygen and iron or iron-rich materials from lunar simulant. Two potential routes were examined to produce useful materials from lunar soil. The first method involved high temperature electrolysis of molten magma for production of oxygen at the anode and a high iron material at the cathode. The second method involved partial oxidation of molten soil followed by cooling and magnetic separation of spinels or ferrite..

Electrolysis of molten magma at 1300C – 1400C under argon was carried out in alumina containers with kanthal or platinum electrodes. The electrolyte used consisted of a mixture of oxides or MLS-1 to simulate a high titanium basaltic material similar to Apollo-11 soil. Post electrolysis analysis indicated a high iron content electrolyte near the cathode with other areas partially depleted of iron. Cell design, electrolysis results and attempts at conductivity measurement are discussed.

Partial oxidation of molten lunar stimulant was carried out at 1400C with air. After partial oxidation, the molten material was cooled at various rates to yield a solidified material. The solidified material was ground and magnetically separated to an iron rich magnetic fraction and a nonmagnetic fraction. The magnetic portion was dissolved in sulfuric acid and electrolysis yielded metallic iron at the cathode with 98% current efficiency.