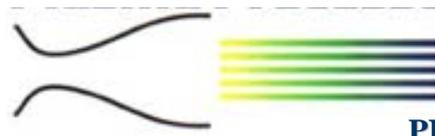


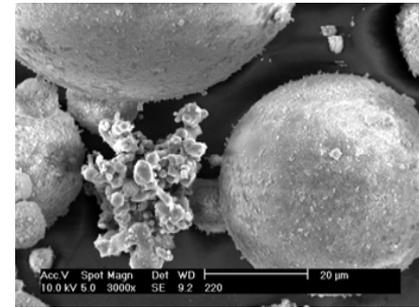
Plasma Reduction of Lunar Regolith
for In-Space Fabrication



PI: Scott O'Dell/Plasma Processes, Inc.-Huntsville, AL, 35811 Proposal No: X9.01-8468

Identification and Significance of Innovation

- Raw materials (e.g. O₂ and metals) are needed for in-space fabrication, life support, and fuel use.
- High fidelity lunar regolith simulants are needed to verify the performance of equipment, mechanisms, structures and processes to be used on the lunar surface.
- One significant limitation of current simulants is the lack of constituents such as agglutinates and volcanic glasses which often contain nano-phase iron.
- The development of both these technologies are vital for long-term Lunar and Marian exploration.



Plasma processed JSC-1A showing agglutinate and volcanic glassy analog particles.



Higher magnification image of nano-sized beads confirmed to be BCC Fe via TEM electron diffraction.

Phase II Research Achievements

- Using plasma spray technology, Plasma Processes, Inc. refined a technique that effectively reduced JSC-1A thereby producing oxygen.
- Thermodynamic calculations were used to predict optimum processing conditions to produce oxygen and metals.
- Characterization indicated plasma processing of JSC-1A also effectively produces agglutinate and glassy spherules analog particles with nano-phase iron, similar to those found on the lunar surface. Therefore, it can be inferred that the plasma processing technique closely duplicates the glass formation mechanisms on the lunar surface.

NASA and Non-NASA Applications

- Feedstock for in-space fabrication: Si - solar cells; Al, Ti, Fe - structural use; O₂ (H₂O) for life-support, habitat and propulsion use, mature lunar simulant for dust, abrasion, mining & excavation research.
- Powder metallurgy products, protective coatings, catalysts, composite additives, sintering aids, microfiltration membranes, rocket fuel additives, rocket motors, electronics, fuel cell technologies

Firm Contacts

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