BLUESHIFT

MOVING TOWARD THE STARS

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CONCENTRATED SOLAR ENERGY FOR MANUFACTURING IN SPACE

Mission:

Blueshift aims to further develop CSE manufacturing capabilities to enable others to achieve their goals in space!

Need? ➔ Precision control and delivery system for CSE

- Broad Applicability
- High Fidelity Experimentation
- Universal Utility

Rationale:

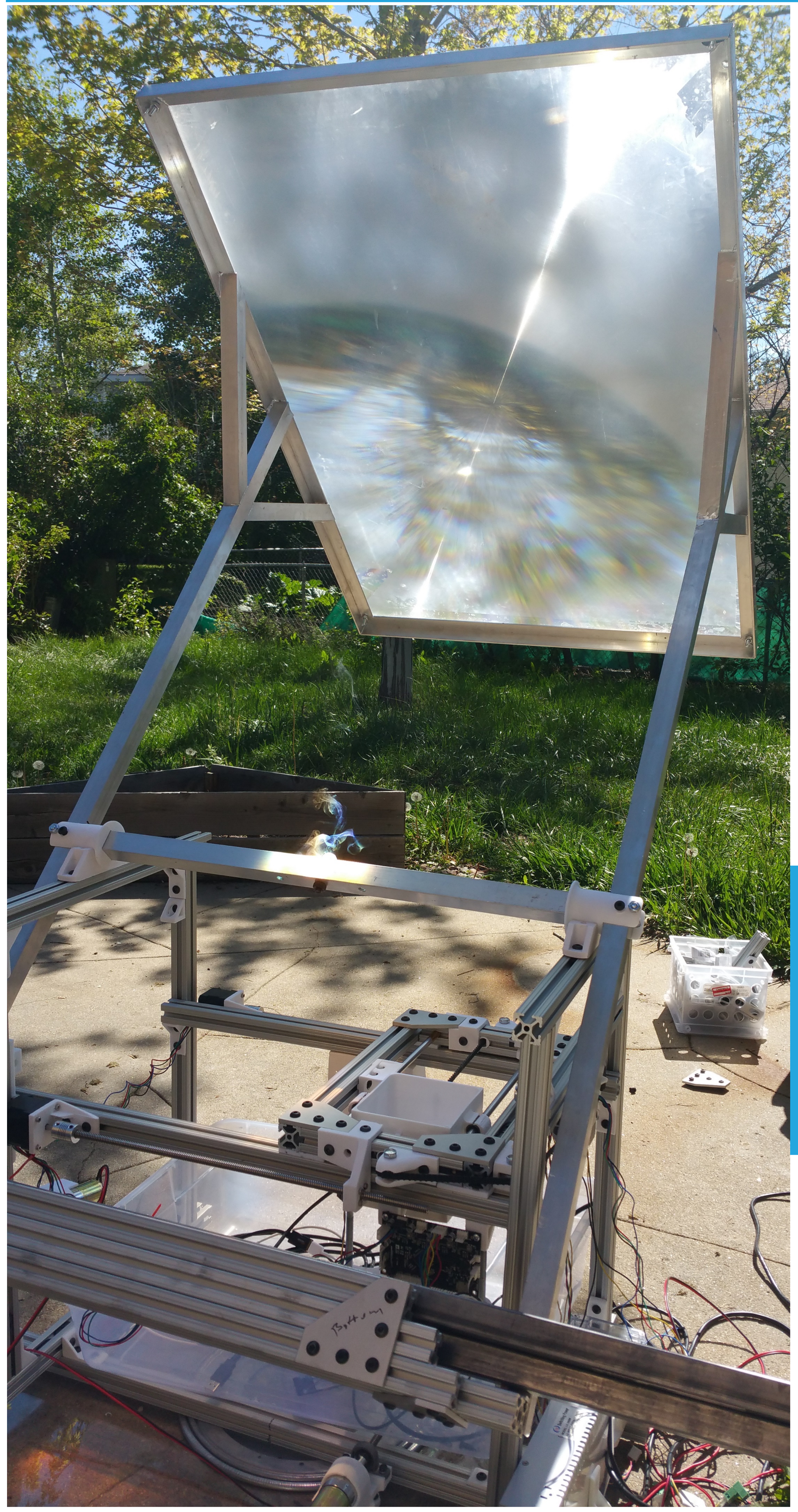
- Manufacturing in space requires an abundance of power for processing local resources into usable commodities, goods, and structures.
- Experiments to sinter lunar and Martian regolith simulants using concentrated solar energy have demonstrated its suitability for quickly producing large structures and low-strength parts.
- Process requires fast feedback control for consistent results.
- Recent tests show potential for producing higher strength components using CSE.

In-Situ Resources as Feedstock

No Launch Costs
Abundant Materials in Space
Numerous Potential Products

- Mechanical Components/Replacement Parts
- Habitats
- Infrastructure (pressure vessels, piping, roadways, landing pads, rail, radiation shielding)
- In-Space Megastructures
- Self-Reproducing Machines

Concentrated Solar Energy



- Abundant Power Source (1,370 W/m^2 at 1 AU)
- High Temperatures (5,000+K)
- Lightweight Concentrators
  - Inflatable Lenses
  - Deployable Mirrors
  - Heliostat Arrays
- Manufacturing Processes
  - Baking
  - Casting
  - Additive Manufacturing
    - Sintering (powder)
    - Selective Melting (powder)
    - Fused Deposition Modeling (extrusion)
    - Directed Energy Deposition (wire-feed)

Our Process:

- 650 W max. power
- 2300 K (3700+ ° F)
- Powder (current) and Extrusion (in development)

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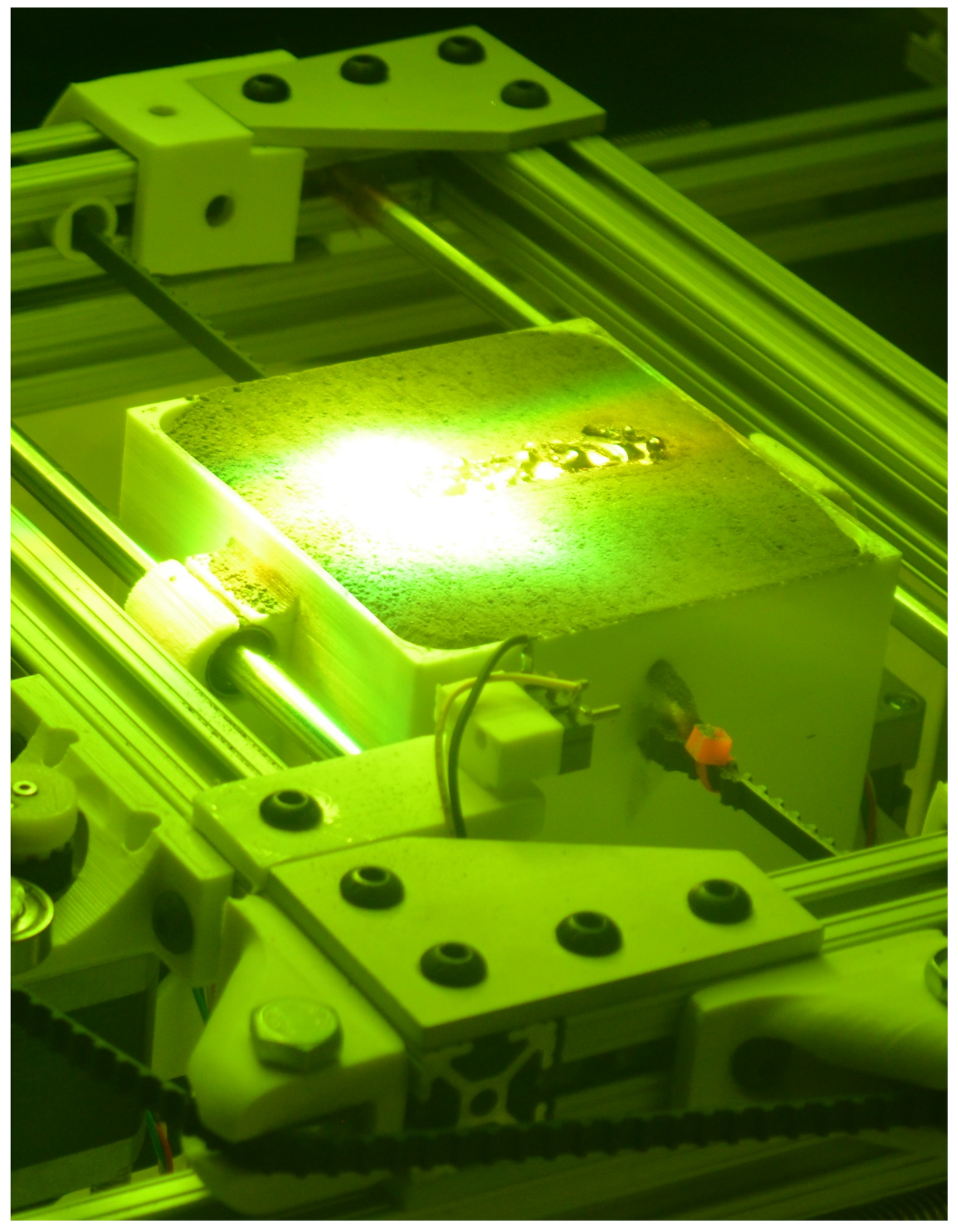
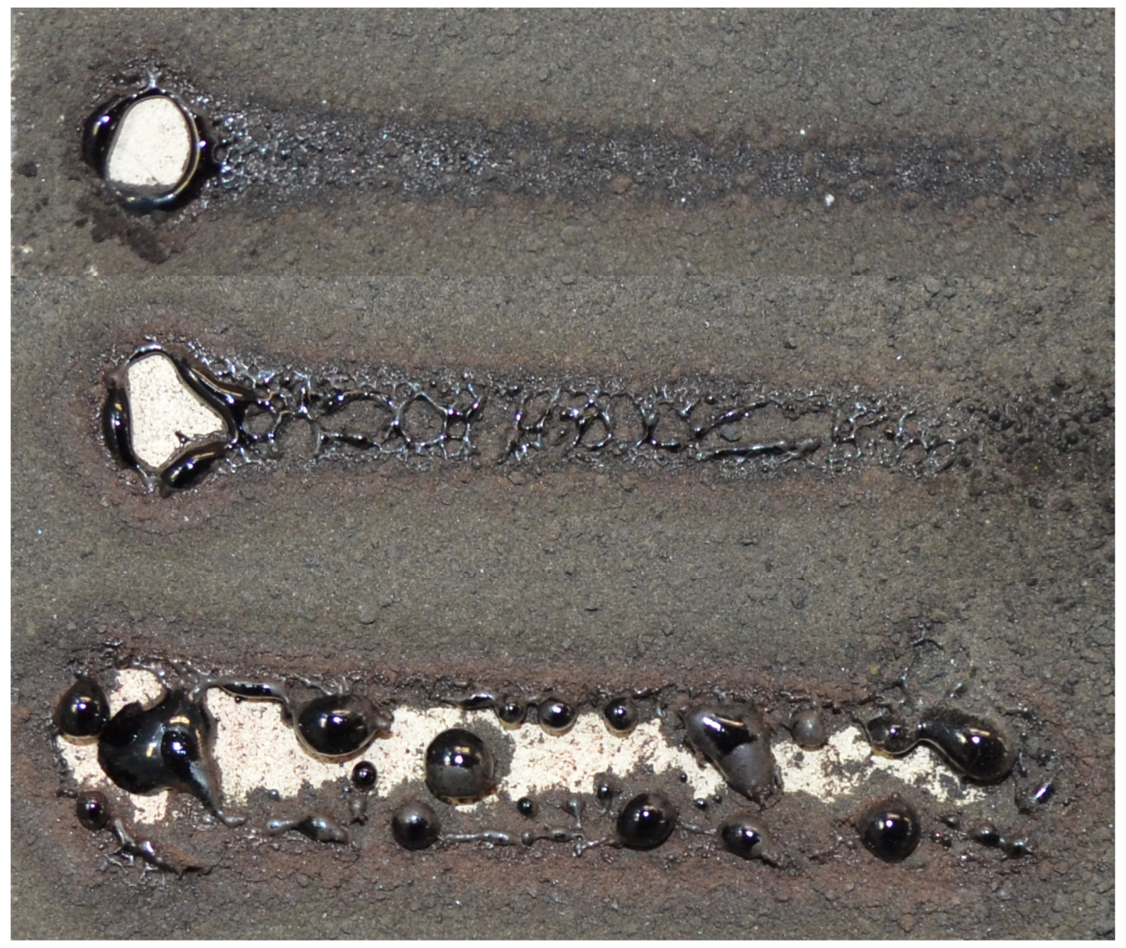
Lunar JSC-1A Sintering/Melting with Direct CSE

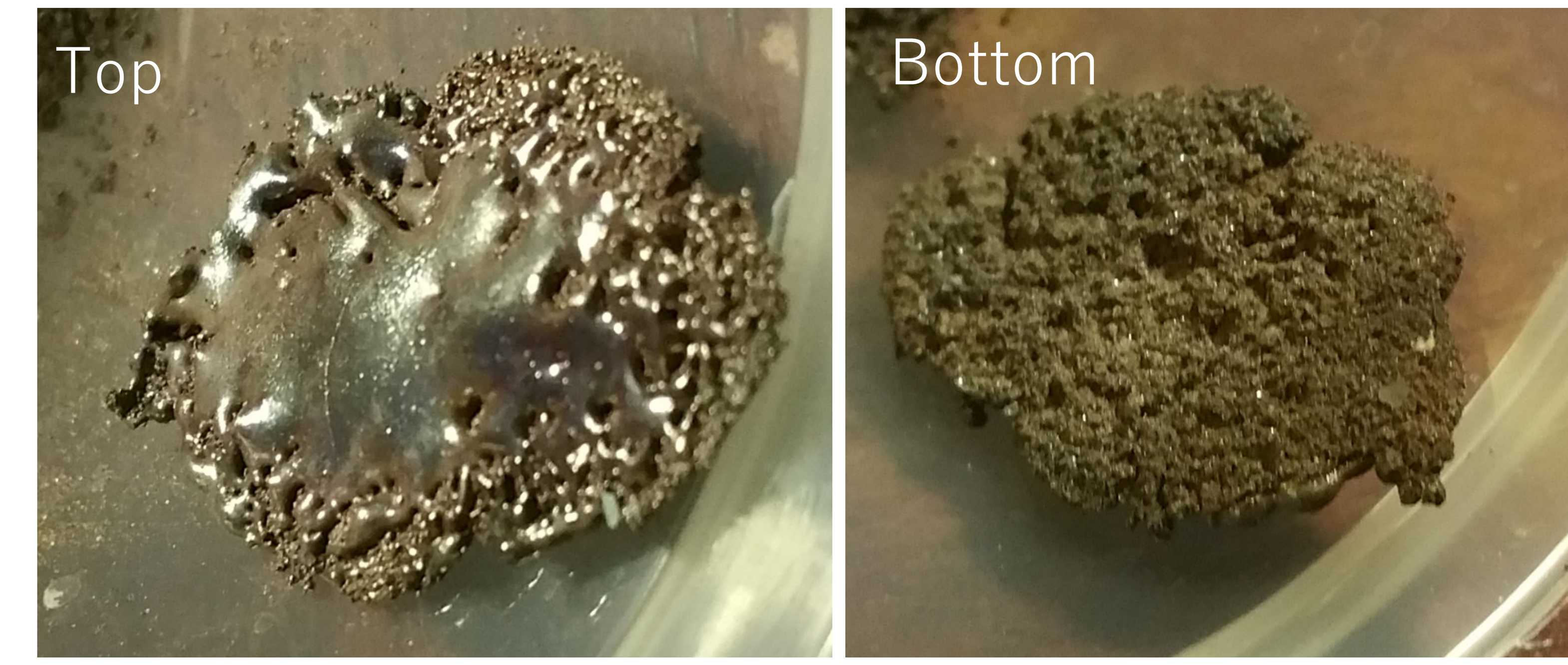




Thin Layer of JSC-1A:

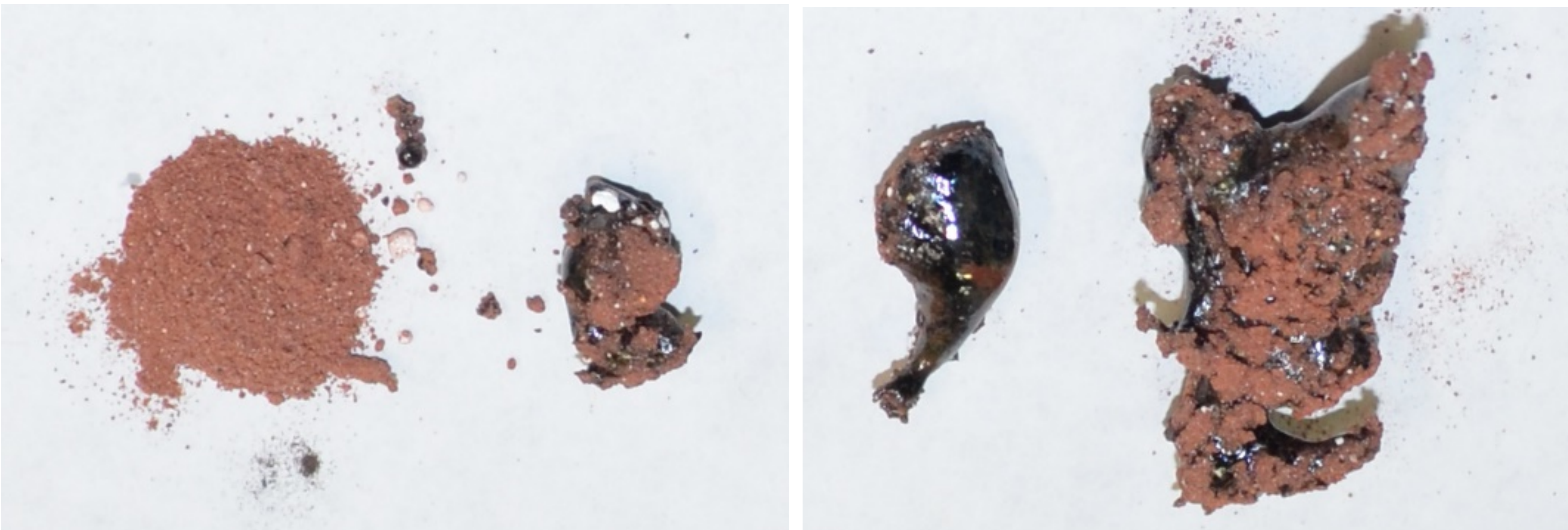
- 4 m/min ➔ Sintered (top)
- 1.4 m/min ➔ Partially Melted (middle)
- 0.6 m/min ➔ Fully Melted (bottom)

Packed Bed of JSC-1A:
Track speeds ranging from 3.6 m/min (left) to 0.6 m/min (right)



Prolonged Exposure to Direct CSE:
Limited penetration depth due to low thermal conductivity of soil and high reflectivity of melted Regolith

Martian MMS-2 Sintering/Melting with Direct CSE



Tests showing MMS-2, Martian regolith simulant loose, lightly sintered, fully melted, and cohesion of larger, unmelted soil particles with melted regolith

JSC-1A Analogue Melting in 2100° F Furnace

Liquid: high surface tension, high viscosity ➔ casting, welding, extrusion-based AM

Solid: dense, high strength ➔ mechanical components, replacement parts, railing, megastructures

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