

CIF 23-4: Metal Extraction from Trash via Trash-to-Gas Processing for Use in 3D Printing

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Activity Type: New Start

Primary STMD Taxonomy: TX06.1.3 Waste Management

Starting TRL: 1 **End TRL:** 3

Executive Summary: This work synergized state-of-the-art trash-to-gas (TtG) and in-space manufacturing (ISM) technologies to successfully extract metals from astronaut waste items for use in 3D printing. This was accomplished by isolating pure aluminum (Al 1235) from astronaut multilayer food packaging via TtG processing, cleaning the extracted aluminum, and preparing it for compatibility with the bound metal deposition (BMD) 3D printing process. A suite of material analyses was performed on the extracted aluminum product to fully characterize the key properties linked to effective additive manufacturing, including particle size distribution, oxygen content quantitation, and elemental composition. Metal extraction from Lunar and Martian regolith has become a significant area of interest for the in-situ resource utilization (ISRU) community to produce metallic equipment for various mission scenarios. However, the extraction of metals from astronaut waste streams has yet to be investigated. This project demonstrated an end-to-end waste metallic reuse process which may garner considerable metal production that would otherwise be disposed of.