Lunar In-Situ Aluminum Production via Molten Salt Electrolysis (LISAP-MSE)

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Project Goals

- Reduction of lunar anorthite to alumina
- Investigate the feasibility of electrolyzing alumina to produce aluminum
- Investigate the creation of an anode with low rate of consumption
- Evaluate the conversion efficiency of aluminum produced by molten regolith electrolysis

Technical Approach

- Anorthite can be reduced to alumina using high pressure and high temperature leaching. A vessel capable of such is shown in Fig. 1
- Use molten salt electrolysis as this method has been proven for numerous other metallic oxides and theorized for reducing alumina to aluminum as shown in Fig. 2. An overview of the entire process is shown in Fig. 3.
- Produce a solid solution electrode with high ruthenium content, as ruthenates have been known to resist chloride melts
- Use XPS located at MST's Material Research Center to characterize the electrolysis product

Figure 1: Acid Digestion Vessel

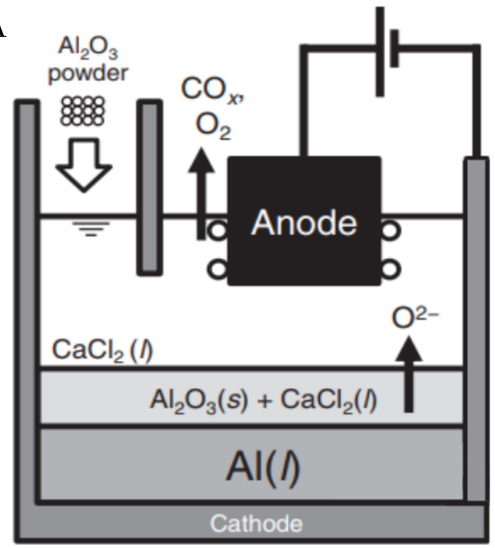

Figure 2: Aluminum Oxide Electrolysis

Testing Apparatus and Facilities

- The electrolysis basin will be constructed using a high nickel alloy that can resist corrosion of the chloride salts at 900°C as shown in Fig. 4
- The apparatus will be tested both in atmospheric and reduced pressure conditions using the vacuum furnace shown in Fig.5

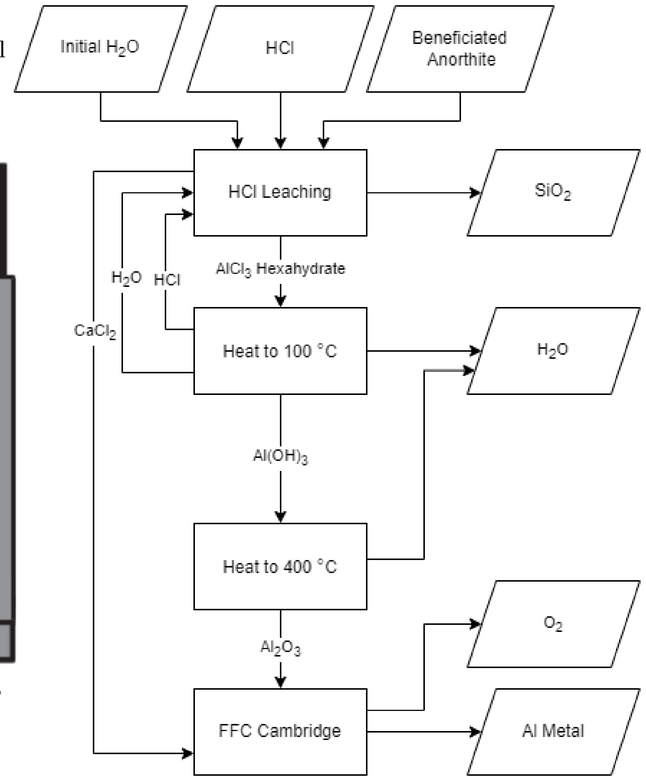

Figure 3: Anorthite Processing Method

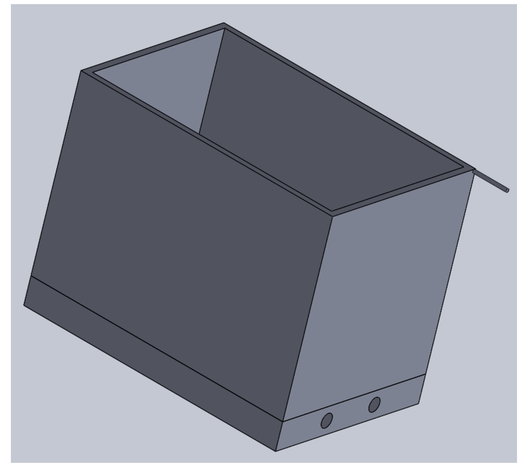

Figure 4: Electrolysis Basin CAD Model

Figure 5: Vacuum Furnace

References

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Acknowledgments

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