



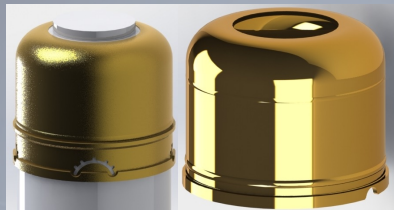
# Uranium Hohlräum Leaching Improvements

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## Leach Overview

The leach step removes the internal metallic mold "mandrel" from the depleted uranium hohlraum. The mandrel is high purity aluminum that is coated with copper prior to the deposition of the hohlraum structure (gold, uranium, gold).



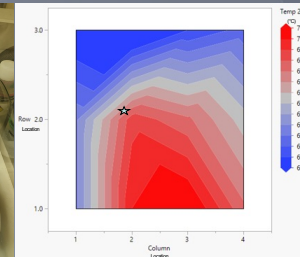
Chemical	Purpose	Ave. Time
Sodium Hydroxide	Al removal	3½ hrs
Ammonium Hydroxide	Cu removal	5½ hrs

## Results

- The shaker provides uniform agitation and temperature control. The reaction rate of the leachant chemistry is more consistent from part to part (uniform agitation) and from run to run (uniform temperature).
- The reduction in leach time variation from part to part assures chemical exposure times are equivalent. This minimized labor since all parts are processed together. Cycle time savings of 2 days with 75% reduction in man-hours.
- Process qualification testing & verification showed no decline in the part quality with the process improvement.

## Temperature Uniformity During the Aluminum Leach Step

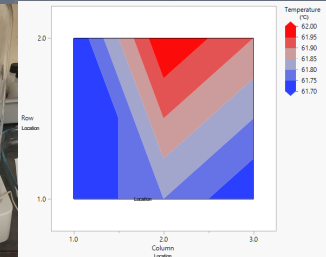
### Prior Leach Fixture



Statistic	Meas 1	Meas 2
Mean Temp (°C)	66.75	65.50
Stddev (°C)	3.41	3.68
Range (°C)	9.00	11.00

- The magnetic stir-bar setup uses 32mm x 200mm glass test tubes with stir bars in the bottom of the tubes. This process requires one of the test tubes to be used for temperature control (thermocouple in solution, thus capacity loss).
- Since the leach process is done in a flow-hood, the airflow passes around the test tubes to the back of the hood. The temperature gradient differed as much as 11°C.

### Current Leach Fixture



Statistic	Meas 1
Mean Temp (°C)	61.80
Stddev (°C)	0.23
Range (°C)	0.30

- The shaker setup uses the same 32mm x 200mm glass test tubes but does not need a stirring device inside the tubes (thus all tubes are available for production.)
- The shaker setup has a plastic shroud with an access panel in the front. The environment is temperature controlled to provide a consistent even distribution of temperature across all the test tubes.
- The temperature gradient was measured in the leach solutions for all the positions & they maintained a uniform temperature (0.30°C was the temperature spread).

## Agitation Uniformity

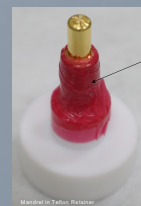


- The magnetic stir-bar unit uses a single magnet in the heated base to cause the magnets in the glass tubes to spin.
- Due to the magnetic field distribution as it spins, the magnets in the tubes have differences in their mixing efficiency.

- The shaker system moves the entire table under the tube support blocks, thus the agitation is the same for each hohlraum being processed.
- The primary limitation of this type of agitation is the weight limit of the mass on the system's shaker table.

## Leachant Contamination Control

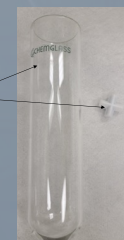
### Old Process (masked)



- To limit the amount of aluminum being digested, the excess area of the mandrel is masked with plater's tape.
- The plater's tape, even though it is made for chemical exposure, still was attacked by the concentrated sodium hydroxide solution. This was apparent since the red color could be seen on the Teflon catch basket after leach.



- The mandrel holder, basket, stir bar, and glass tube have to be cleaned prior to use to prevent process contamination



### New Process (no mask)



- By cutting the hohlraum off from the mandrel, the amount of aluminum being digested is more consistent
- The cutting tool is cleaned prior to use to avoid contamination.
- The absence of the mandrel mask, reduces foreign material in the leach solution

