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Title:	My Journey to Plutonium Casting Operations at LANL
Author(s):	Wheeler, Meagan Daniella
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My Journey to Plutonium Casting Operations at LANL

Presentation to Summer Physics Camp for Young Women

Meagan Wheeler

TBD

Who am I?

- I grew up in Nambe and attended Pojoaque Valley Schools from 5th grade until I graduated high school
- Growing up in Northern New Mexico made me realize I love being outside I frequently went:
  - Camping
  - Hiking
  - Hunting

Figure 1: Camping with my dog Levie.

Figure 2: Hiking with my best friend in Sedona, Arizona.

Figure 3: Hunting with my father, uncle, and cousins.

How did I get interested in STEM?

- It started with a science class in middle school
  - I was interested in the scientific method and the process of designing an experiment
- In high school I took chemistry it was challenging.
  - I was the kind of girl that if something was difficult I desired to learn more so….
- I majored in Chemistry at Northern Arizona University
  - I was working with designers at LANL, however, so I decided to minor in mechanical engineering
    - These two degrees felt like they fit me well but…
- I decided I hadn't had enough and went to Colorado School of Mines to complete my Masters of Engineering in Metallurgical and Materials Engineering.

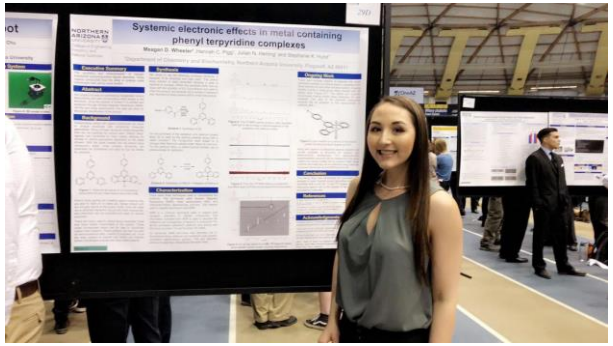


Figure 4: Undergraduate research symposium.

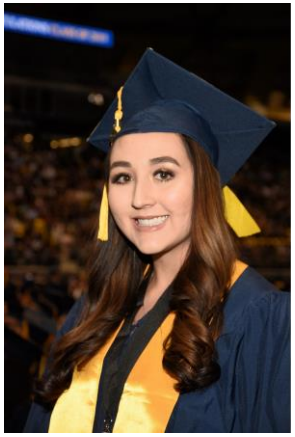


Figure 5: Graduation from Northern Arizona University.

Figure 6: Graduation from Colorado School of Mines.

What on earth is Metallurgical Engineering?

- Metallurgy is the study of the properties of metals and how they are produced.
  - This is the study of the physical properties, how they are extracted and where they come from (how they're formed)
  - There are a lot of aspects of chemistry and mechanical engineering in metallurgical engineering depending on the area or material
- So metallurgical engineering is producing metals that can be used for various applications.
  - Focus areas / industries that metallurgists go into are:
    1. Medical Devices - Implants (pacemakers, hips, knees etc.), Stints, Prosthetics
    2. Electronics
    3. Space Exploration

Figure 7: Worker casting a metallic material.[1]

Figure 8: Diagram explaining metallurgical engineering. [2]

Figure 9: Metal being cast into molds. [3]

(1) http://content.time.com/time/specials/packages/article/0,28804,2073703_2073653_2073697,00.html
(2) https://mineslife.wordpress.com/2015/02/12/metallurgical-engineering-what-is-it/
(3) https://www.aboriginalaccess.ca/adults/types-of-engineering/metallurgical

Plutonium Casting

- So what do I work on?
  - I'm a metallurgist in a (actinide) foundry that melts and casts nuclear materials
- Plutonium is a strange material to work with and offers a variety of challenges
  1. Work needs to be performed in gloveboxes (Figure 4)
  2. Negative pressure needs to be maintained throughout the facility

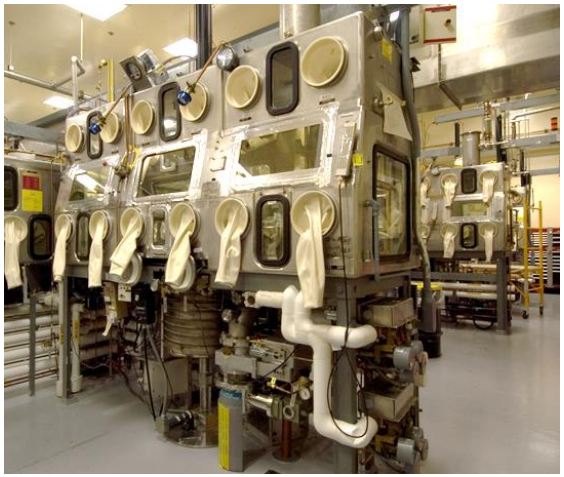
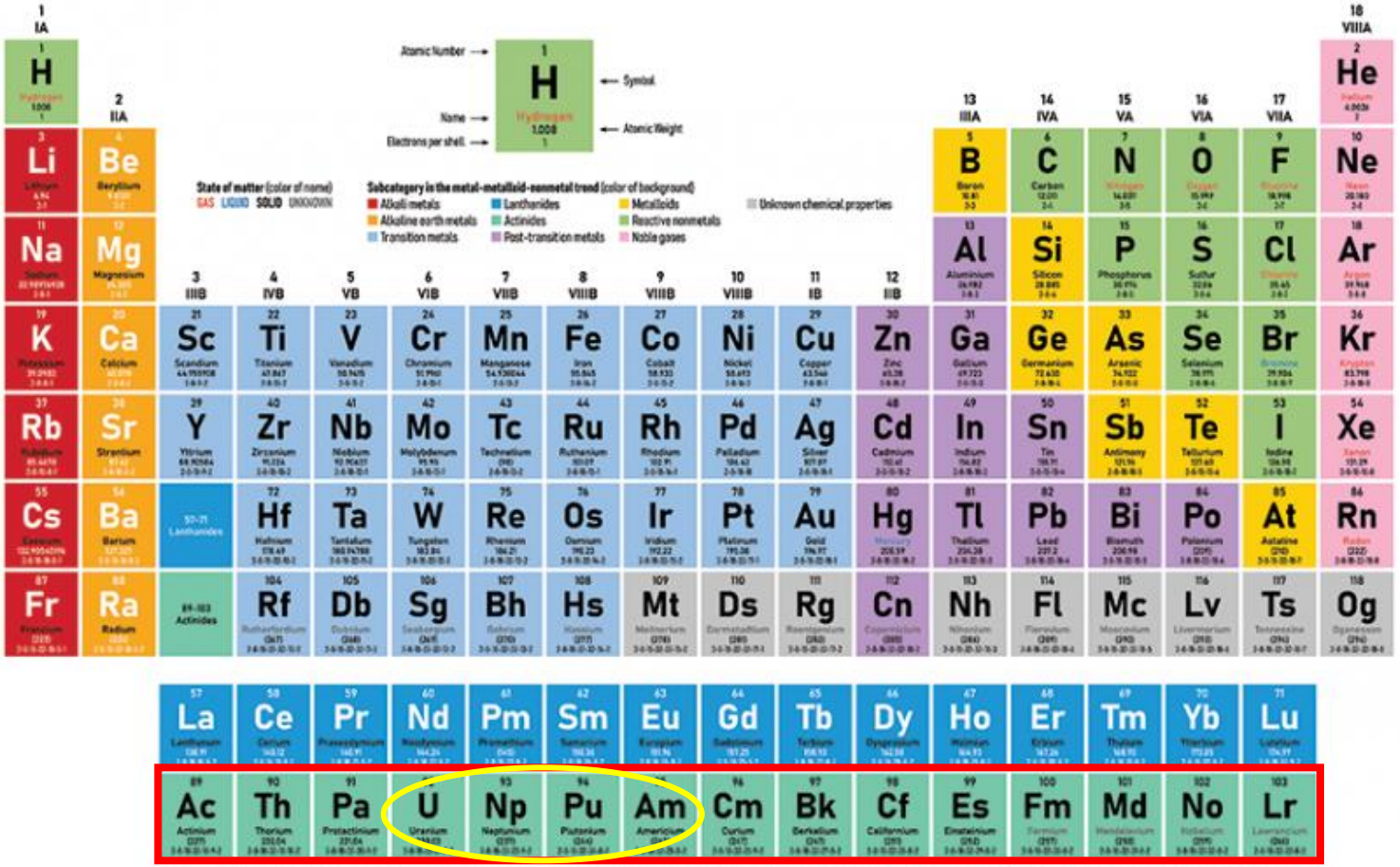


Figure 10: Model of vacuum induction furnace.

Figure 11: Glovebox worker. [4]

(4) https://dchas.org/2017/06/21/ergonomics-of-glove-boxes/

Periodic Table of the Elements



Plutonium Casting

- Plutonium is processed in a vacuum induction furnace (Figure 5)
  - How does this work?
- Induction Furnace Explanation

https://www.youtube.com/watch?v=RgFEiRu7sUM

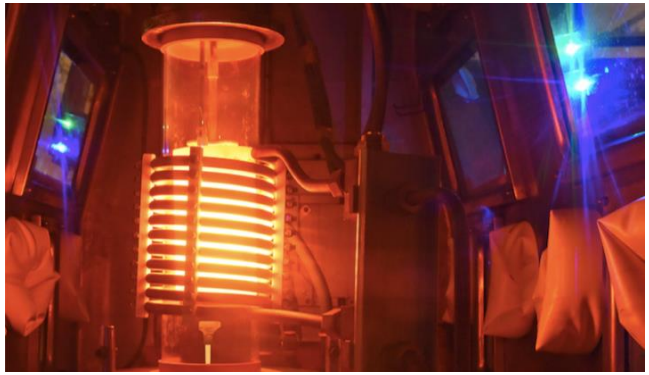


Figure 12: Images of casting operations inside glovebox.

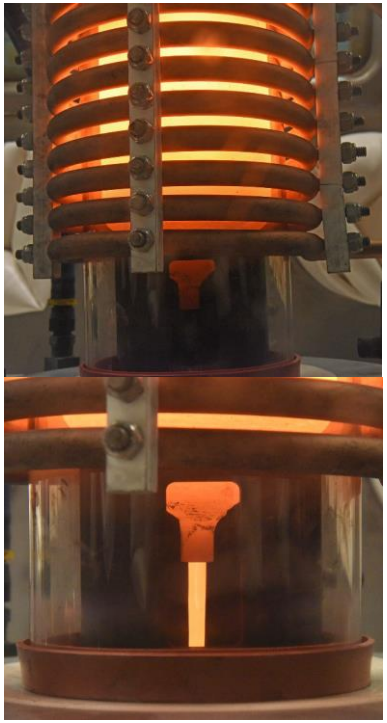


Figure 13: Images of casting operations.

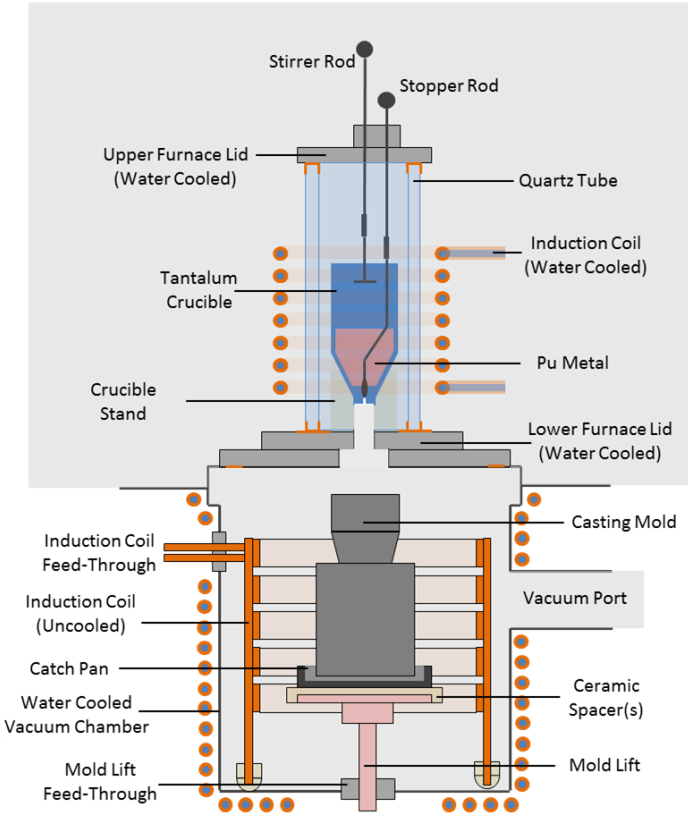


Figure 14: Model of induction furnace.

Casting Material and Product

- The casting process beings with a ring of plutonium that is broken down and placed into the induction furnace
- The next step is to cast rods which are easier to work with than the starting material
- So after the casting operations are completed what are we left with?
  - The final casting product is the puck

Figure 15: Plutonium ring.

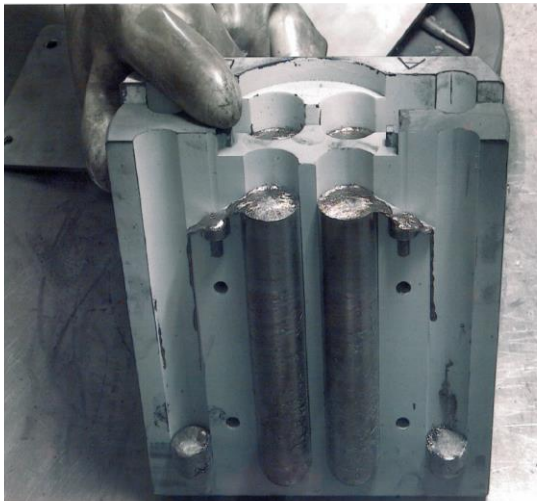


Figure 16: Recast plutonium metal rods.

Figure 17: Final cast plutonium puck.

Casting Videos

- Bronze casting using the lost wax process

https://www.youtube.com/watch?v=D2LTsD8IE_s

- Sand casting video

https://www.youtube.com/watch?v=WXx_KguZTC4&t=3s

- Large scale steel casting

https://www.youtube.com/watch?v=WXx_KguZTC4&t=3s

Los Alamos NATIONAL LABORATORY

Questions?