Project title:

*Creation of device for crucible extraction from electron beam evaporator*

Engineering discipline(s):

Mechanical Engineering

Required skills, materials and equipment:

**Skills:** Mechanical design, FEA

**Materials:** Crucible

**Equipment:** e-beam evaporator

Background and motivation: *What is the current situation and how would this project improve it?*

The electron beam evaporator located in Goergen holds material samples in small crucibles inside the machine. An example of the crucibles containing materials is shown in the image below. Crucibles can be made from a carbon or aluminum oxide material and contain various high purity material samples. The Goergen evaporator contains four crucibles that may be indexed to allow multilayer depositions without removing the target substrate from vacuum. These crucibles must be removed and replaced between runs whenever the deposition recipe requires different source materials. The removal process is difficult due to a number of factors:

- It needs to take place in a clean room environment
- The crucibles are located deep inside a small enclosure which makes removal difficult
- The crucibles need to be very carefully handled upon removal, since any cross contamination of the samples will compromise the experiment. Oxide deposition materials in particular are very prone spilling since they do not melt and adhere to the crucible.
- Crucible exchanges must be made quickly in order to reduce detrimental adsorption of atmospheric particles within the vacuum chamber.

The current method of removal is to use a set of cleanroom tweezers. This is difficult and error prone.

**Objective: What does this project hope to accomplish?**

The goal of the project is to create a device to allow for the efficient manual removal of samples from the evaporator. This device needs to be compatible with use and processes associated with a cleanroom, not damage or compromise the samples in any way and satisfy appropriate cost constraints.
Deliverables: What specifically should the project produce in order to be a success?

- Benchmark of current system. Understanding of current process
- Complete set of requirements and specifications for system
- Identify several design concepts that will solve the problem. These may include both manual and automated processed.
- Decision matrix indicating most promising alternative
- CAD of design proposal, including associated drawing package
- Prototype of design
- Ideally a working breadboard/engineering model