



SAND CASTING - LAB 2

Instructor: Dr. M. Cem Çelik

Objective Experience the sand casting process. Understand the details of the process.

I. Sand Casting

Sand is used as the mold material for casting processes. In this experiment, two different sand casting method will be investigated.

- **Green sand** that uses organic inexpensive sand
- **Resin sand** that uses silica and binder mixture



Figure 1. Sand types for the experiment

II. Equipment

Sand mold will be prepared inside of the cope and drag as seen in the Figure 2.



Figure 2. Cope and drag

Part and patterns were fabricated by Ultimaker2 Extended using PLA filament as shown in Figure 3. Sprue and riser will be formed by cylindrical parts as seen in Figure4.



Figure 3. FDM printed parts

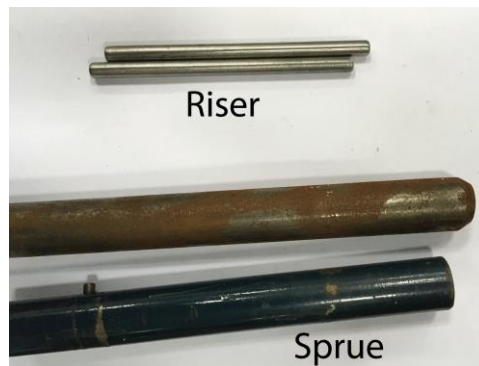


Figure 4. Sprue and riser

Aluminum raw material will be provided. This will be heated up by a thermal furnace as seen in Figure 5.



Figure 5. Thermal furnace



III. Procedure

In this experiment, you will first form into two groups. Each group will use different sand for the experiment.

a. Green Sand

Green sand should be wet to form the shape of the patterns. Therefore, a cup of water will be poured and sand will be mixed. When you squeeze the sand in your palm, it should take the form without collapsing. When it is ready, put your FDM printed part with runner on the ground. Use the drag as reversed. Then, start pouring the sand by using a sieve. Once all the part is covered by sand, you can gently apply some pressure to form the sand. Next, you pour more sand until you fill at least half of the height of the drag. Then, you use a flat and heavy bar to punch the sand. Make sure there no loose sand is left. Repeat until fully filling the drag. Flatten the top level of the drag. Once it is ready, you flip over the drag. You will see your pattern at the top now. Engage your cope on top. Put the other printed part on the surface. Insert your sprues and risers. Then, repeat the same process to as in the drag to fill with the sand.

Once it is ready. You unlock the cope and drag. Flip over the cope, and then remove the patterns. Thus, you will obtain your cavity and fluid channels. Reassemble your cope and drag. This will make it ready to pour the metal inside of it.

b. Resin Sand

You will use approximately 3,200 g of Silica to fill the drag first. You will measure the sand weight with a scale that is limited to max 500 g capacity. Once you have the right amount of sand, you will prepare your resin mixture. You pour into a cup of resin that weights 0.2% of the sand and pour the catalyzer of 0.05% of the sand weight. Mix the resin mixture. Then pour into your silica powder. Mix it gently for about 2 min. The curing time of the mixture is ~20 min. Therefore, you should be quick.

Once the mixing is complete. Gently pour place the sand into your drag where the FDM part with the runner is placed. Fill the half, and apply gently pressure. Last, flatten the top level. Now, you need to wait for the curing about 15 min.

You can prepare the other mixture of the sand for the cope. You will do the same steps as described in the Green sand section.

When the molds are ready, the molten pure Aluminum at 850 °C will be poured through sprue. Each group will cast two identical tensile test specimens. After the casting, you will wait 10 min leaving the mold alone. Then, you can break the mold and leave the metal to cool at room temperature. Once, the metal parts at room temperature you will give one part of yours to other group for the next week experiment.



IV. Assignments

- Follow lab reporting steps while preparing your lab report.
- Present the details of your experimental procedure. Provide figures to show the steps.
- How did the final part look like?
- Measure the dimensions of the part? Compare to the patterns you used. How far your tolerances?
- What did go wrong if any? Why?
- Discuss your part details and quality? How would you improve the process?

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