EXPERIMENT DIARY 01-22

DROSS.

DESIGN DIPLOMA

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FALL 2020 OSLO SCHOOL OF ARCHITECTURE AND DESIGN

THURSDAY 20.08 | #1

DESIGNING AND BUILDING THE FURNACE

Had a couple different designs, but the most promising was the two options pictured on the right. I ended up building figure 2. I had some trouble with the mortaring the firestones. The mortar I mixed seemed too dry and ended up cracking a few places as well as leave small gaps. I don't know if this is a positive thing (let the furnace breath) or negative (let to much heat escape). I would have to remove the whole lid to be able to feed the furnace soda cans, compared to if I had made a hole to drop them into the crucible.

QNT	INVENTORY LIST	NOTES
30	Firestone bricks	More water in the mortar mix. More bricks (so I don't have to have the last ones upright), makes it more stable. Construct hole in lid for easy refill of aluminium?
4,5	Kg of firestone mortar	
1	Mini pallet	
3	Fire extinguisher	

EXPERIMENT: SUCCESSFUL

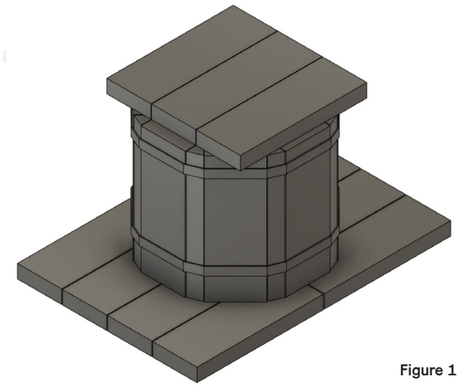


Figure 1

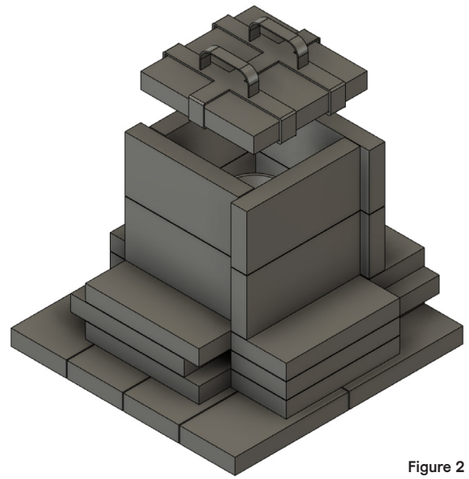


Figure 2

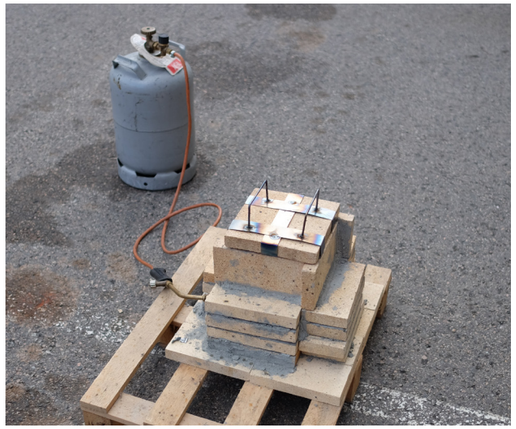
TUESDAY 25.08 | #2

FIRST BURN

First go with the furnace after some minor fixing over the weekend. I only had one available tank of propane and with two holes for it, the other hole became ventaiilation and let out some heat. I got some aluminium scrap that was intended to melt first then add the soda cans later, but I never got that far as it started raining after 10min (molten aluminium will explode on impact with water). And after 10min nothing spectacular had happened. Everything but the aluminium was scorcing hot.

QNT	INVENTORY LIST	NOTES
1	Firestone furnace	Don't remove lid to check the progress too often as it lets out the heat you're trying to cultivate. Let the nozzle of the propane tank breathe free air (don't place it too far in as it won't be able to get oxygen for the ignition). Disasembled to allow scrap feeder opening at top.
1	Propane tank	
1	Fire extinguisher crucible	
5	Aluminium scrap pieces	
25	Aluminium cans	

EXPERIMENT: FAILED (known reasons)



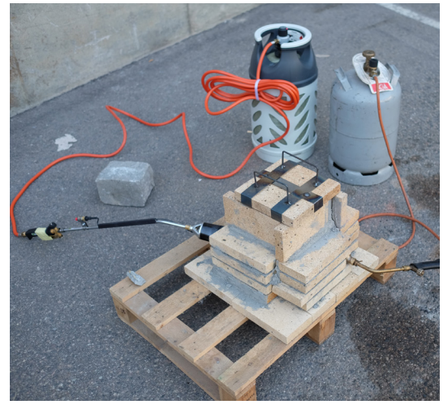
WEDNESDAY 26.08 | #3

EXPERIMENT #1

First melt. Had two propane tanks this time and the aluminium was molten after just 10min. The dross on the top of it was mostly aluminium cans that were not burned long enough it seems. I pushed the dross down to mix it with the aluminium, but when went to pour it in the muffin mold the aluminium pierced through the dross leaving me to have to scrape out the dross at the end. The two fused pretty good, but I expect that was mostly the aluminium binding the dross.

QNT	INVENTORY LIST	NOTES
1	Firestone furnace with lid	Burn the dross for longer and stir it to break up the larger lumps. When pouring in mold be mindfull that aluminium is much more liquid and will pour out first. Try to scrape out dross as you pour into mold.
2	Propane tank	
1	Fire extinguisher crucible	
5	Aluminium scrap pieces	
25	Aluminium cans	

EXPERIMENT: FAILED/SUCCESS (first try so nothing to compare with)



FRIDAY 28.08

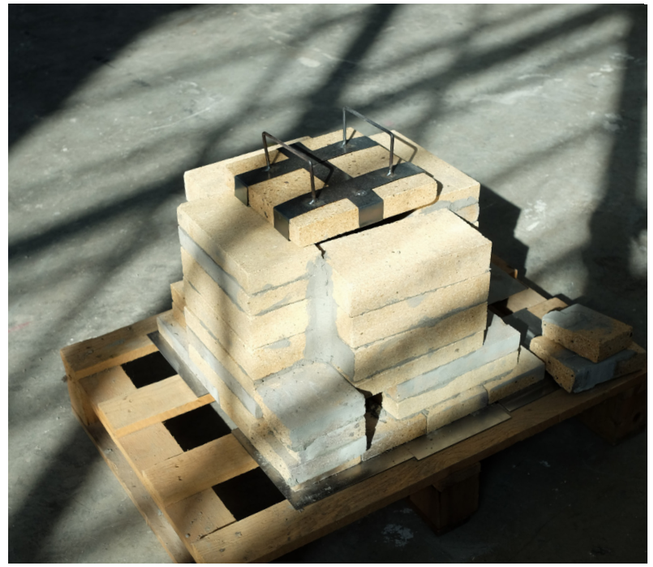
#4

NEW IMPROVED FURNACE

After the first melting, I decided to rebuild the furnace following my notes. This is more sealed than the first one and a more optimized for the nozzle of the fire outlet. I believe this new furnace will reach melting temperatures much faster as it has far fewer gaps between the bricks, this will allow me to experiment with the dross faster.

QNT	INVENTORY LIST	NOTES
10	50mm firestone	I hope the two fire nozzles are able to burn in circulation with the fillets of the inside corners.
1	Propane tank w/ large nozzle	
4,5	Kg of firestone mortar	

EXPERIMENT: SUCCESS



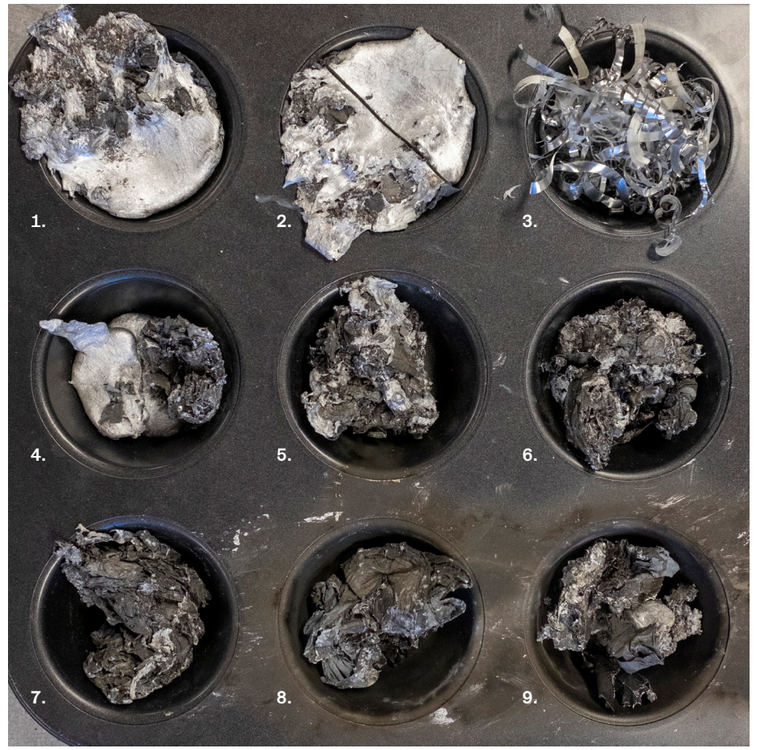
MONDAY 31.08 | #5

POST PROCESSING MATERIAL TEST #1

Cutting, sanding and testing the attributes of the aluminium dross tests. Some contain more aluminium than others. It is clear that some of the dross test were not fully melted even though i stired it. Cutting the test open revealed that the dross was mostly on the surfaces. It looks like the flow of aluminium have pushed the dross to the sides and top.

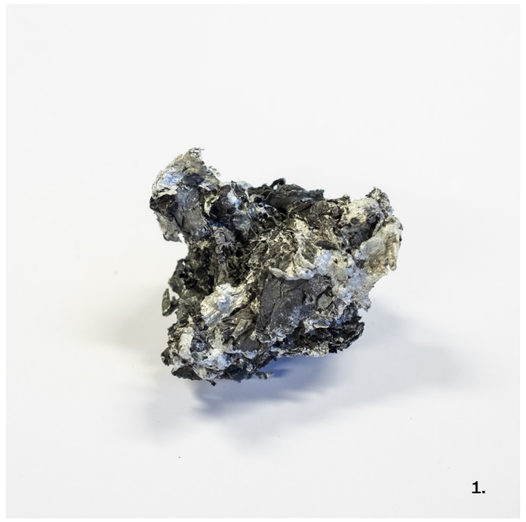
QNT	INVENTORY LIST	NOTES
2	Aluminium mixed with dross	Some of the aluminium dross were still scrap, it just fused. 10 more minutes should do it. Try to preassurize the dross down in the aluminium to fuse it.
1	Aluminium shavings	
1	Aluminium and dross fused	
5	Bundels of dross	3 pipe preassurized dross testing Pour 1 untouched, just as is Pour 2 mixing the dross and aluminium Pour 3 layers of alu, dross, alu, dross
-	Mixed residue (testable?)	

EXPERIMENT: SUCCESS



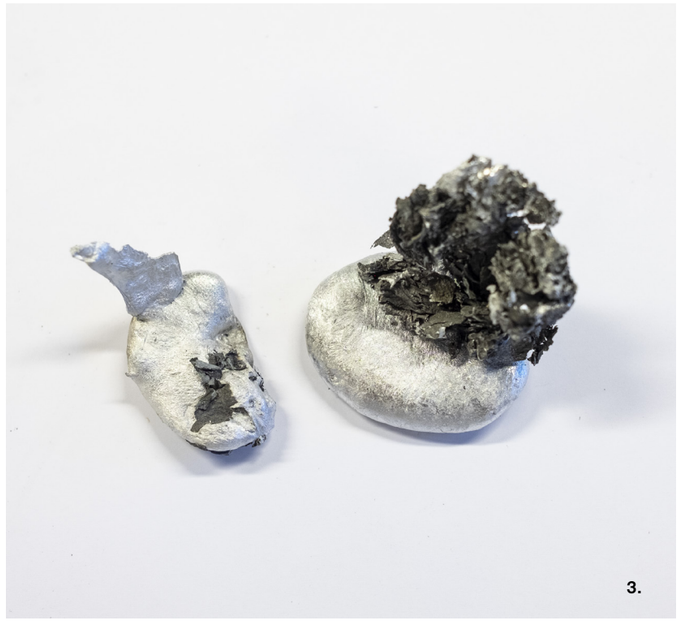
TEST 1 RESULT

1. Aluminium cast with the least amount of dross.
2. Aluminium with some dross and some unmelted cans (cut in half for exploration).
3. Aluminium shavings
4. Pure aluminium and dross fused together. (connection medium strong).
5. - 9. Dross lumos placed in order from most dross to unmelted scrap



1.

2.



3.

4.

1. Unfinished dross (not melted completley)
2. A blend of aluminium and dross muffin cut in two
3. Aluminium and dross fused together
4. Muffin cut in half + unfinished dross mixed with aluminium

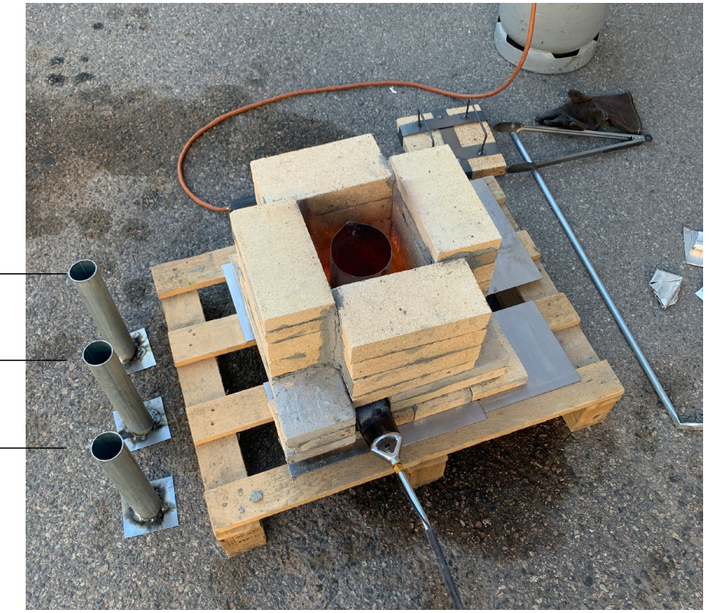
TUESDAY 01.09 | #6

SECOND BURN (FIRST WITH NEW FURNACE)

With the new setup the first batch i threw in was already molten after 5min. Everything was going well for the first 20 minutes then the pallet caught fire and things got pretty hectic. The molten aluminium looked ready to go so I poured it into the first pipe which imidetly started leaking, I moved on to the next which turned out ok, but I ran out of material so I only got one out of three test. It makes it difficult to compare so I'm preparing to make two new tests tomorrow.

QNT	INVENTORY LIST	NOTES
40	Aluminium cans	Weld bottom of pipes better. Layer the dross and aluminium so it fuses better. Find a solution to move the furnace around, maybe on something that dont burn... Probably only need the big propane torch for the next burn. Make one more test pipe.
9	Aluminium and dross tests	
4	Aluminium scrap sheets	
3	Steel pipes to pour tests in	

EXPERIMENT: FAILED (2/3 failed)/SUCCESS (1/3 was completed)



3. Still remains as result of lack of material

2. 50/50 test complete

1. Leaked and was lost

The wooden pallet caught fire (who knew?) and the melting process came to an end with a full plastic bag of aluminium cans left.

Figure 1

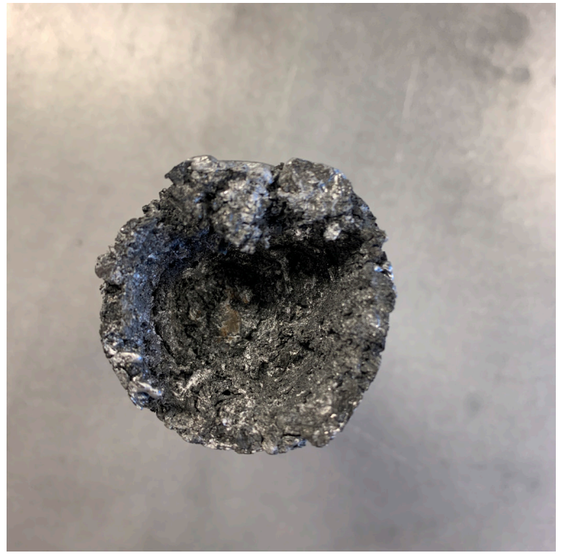


Figure 3

Figure 4

WEDNESDAY 02.09 | #7

POST PROCESSING MATERIAL TEST #2

The 50/50 test came out pretty interesting, but I quickly noticted the weak connection between the two materials. The dross with some aluminium surrounding it, had a hard shell (probably the aluminium) with a rubbery consistency. The aluminium fused pretty good to the sides of it, but not to the bottom where the “pure” aluminium was.

QNT	INVENTORY LIST	NOTES
-	Metal grinder	Would it be posible to make a long rod with a dross core and bend it to a shape? Could be interesting to scuplt it to a product. Find aluminium properties like: heat conduction, softness in use as a product (will it dent easily?), needs coating?
-	Sandpaper (180, 260, 320 gid)	

EXPERIMENT: SUCCESS

Refered to as the 50/50 test

THURSDAY 03.09 | #8

STAMP FUSING THE DROSS

I created a pipe and filled it up with dross. For each “handfull” of dross I stamped it to fill out the pipe. Seemed to bind the dross untill I opened the pipe to realize that the dross did not bind to itself as I had stamped the dross to create a flat surface, making the next “handfull” of dross unable to bind.

QNT	INVENTORY LIST	NOTES
1	Steel pipe	To bind it better, don’t stamp it often, but wait until all the dross have fill the mold then preassurize it. It might be difficult as the dross cools down, it might not bind as well as when it’s hot.
1	Previous test	
1	Stamp tool	

EXPERIMENT: FAILED

FRIDAY 04.09

#9

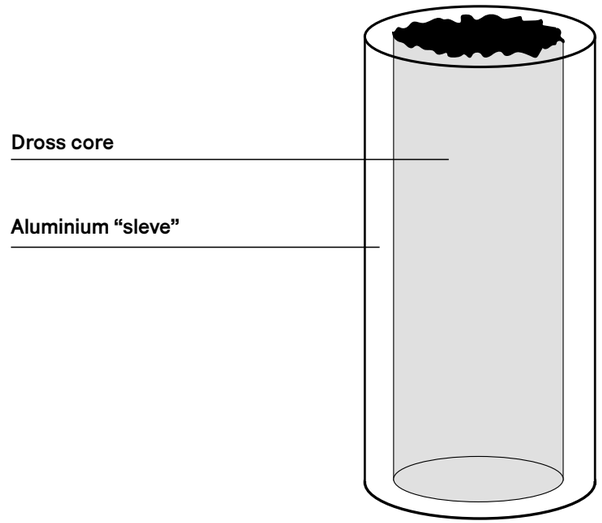
NEW IDEA FOR FUSING

IDEAS

1. Have a core of dross. would help using less aluminium. Would function as filler.
2. Using dross as joinery in connection pieces as the texture allows for the aluminium to surround and grip the dross. This could be done at both ends and would create a distictive form language.
3. As dross is very light it could make for interesting texture on a surface. Molded dross.

QNT	INVENTORY LIST	NOTES
-	Metal grinder	The 50/50 test revealed that the dross doesnt bind/fuse very well to the aluminium, as the test (figure 1, 3, 4) was somewhat easy to separate by hand (with a rubbery like resistance)
-	Sandpaper (180, 260, 320 gid)	

EXPERIMENT: SUCCESS



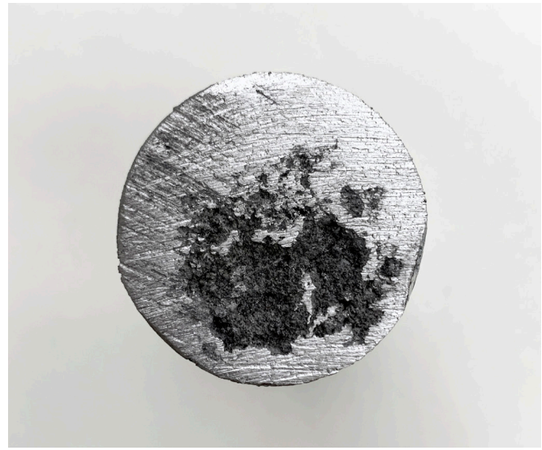
MONDAY 07.09 | #10

CASTING DROSS CORE

Casting the core test was fairly unproblematic. I filled an aluminium pipe with dross and again placed that in a steel pipe that was heated to the aluminium pipe was molten and had fluidly fused with the dross. It fused as good as I would think so over all a successfull test.

QNT	INVENTORY LIST	NOTES
-	Metal grinder	The dross core was somewhat lighter, but after casting it I don't really see any real value in it. I'm leaning towards the aestetics of dross rather than its functionallity.
-	Sandpaper (180, 260, 320 gid)	

EXPERIMENT: SUCCESS



TUESDAY 08.09 | #11

PREPARING FOR TILE TESTS

The box for the sand casting of the dross core test is ready. It's 300mm high which mean the test will probably come out as 200mm ish. I would prefer to have the cylinder shape as small in diameter as possible, but the real issue it how to cast the dross in a cylinder. I'm thinking I will have a pipe with a plate welded on the bottom and scrape and pour the dross in and push it down so it hopefully fuses enough to maintane the cylinder shape.

QNT	INVENTORY LIST	NOTES
5	300x300mm plywood	Should have made the sand casting box higher than 300mm, so the bend test could be done easier.
-	Casting sand	

EXPERIMENT: SUCCESS

THURSDAY 10.09 | #12

POURING ALUMINIUM OVER DROSS

This proves that with enough aluminium even dross can become durable.

QNT	INVENTORY LIST	NOTES
5	300x300mm plywood	Less aluminium poured in the mold.
-	Casting sand	

EXPERIMENT: SUCCESS

WEDNESDAY 23.09 | #13

DIPLOMA ANALYSIS

Interesting read, I believe what I can take away from these projects is the structure:
Introduction: explains the background for the project
Stage 1: is about studies and experimentation done during the length of the project
Stage 2: explains the development of concepts and products
Stage 3: Show results and final products.

QNT	INVENTORY LIST	NOTES
-	Ashes to Ashes	Good insight but other than the structure I believe working with wood and working with dross will require very different methods of exporation.
-	VVOOD	

EXPERIMENT:

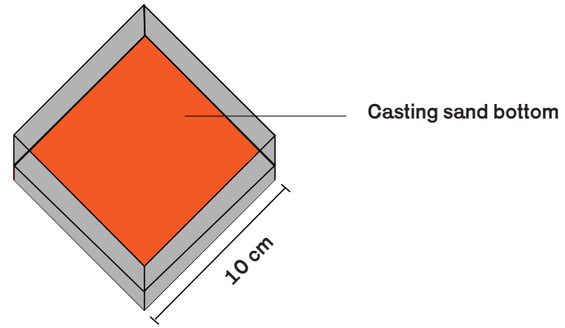
TUESDAY 27.10 | #14

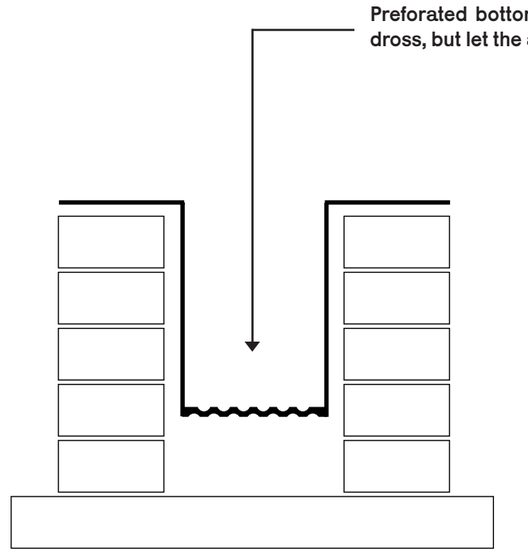
ALUMINIUM FLOW THROUGH TEST

I've created two tile moulds at 10cmx10cm and made a structure to drain aluminium from the dross test. The 10x10 moulds have casting sand in the bottom for easy release. The aluminium draining structure was made out of preforated steel which is connected to four legs holding it in place. Though I ended up filling the bottom with casting sand and just cast dross with aluminium cans and scrap above, which melted and fused really well.

QNT	INVENTORY LIST	NOTES
1	Perforated steel plate	I think I might be onto something here. it seems that when the dross is placed in the mold beforehand and the aluminium is heated to the point where the liquid sinks it creates a really solid outcome. I have to check the consistency
8	Steel wall pieces	
4	Steel rods	
-	Casting sand	

EXPERIMENT: SUCCESS





WEDNESDAY 28.10 | #15

TILE CASTING

I casted two tiles. Both were made out of two earlier dross tests. One with just fine grinded dross and one where I poured aluminium in the bottom and then preassurized the dross as a cover. I was supposed to flip the aluminium and dross test and then melt it on a elevated and preforated plate, but I ran out of propane. I'm leaving for Molde to visit Real Alloy tomorrow so I won't be able to do that test until firday.

QNT	INVENTORY LIST
2	100x100mm tile molds
14	Steel wall pieces
2	Steel rods
-	Casting sand

NOTES

The more I stir the dross while smelting the more incoherent it gets, but it does break up the larger lumps allowing the dross to be moolded with higher precicion. When pouring aluminium first, I don't think the dross fuses to the aluminium because of the thin top layer of aluminium hardens and won't be penetrated by the dross.

EXPERIMENT: SUCCESS

WEDNESDAY 04.11 | #16

POST CAST: MAJOR BREAK THROUGH!

Major break through. The aluminium reduction test was never completed, but the casting structure I made proved to have some advatages for getting consistent results. Instead of having a perforated bottom plate, I filled the bottom with a thin layer of casting sand. I then poured dross from previous test that is pretty fine grinded in the mould and placed over aluminium over. I had it in the furnace for about 10min when the aluminium was molten and the dross started to move upwards. I stoped the furnace and let it air cool.

QNT	INVENTORY LIST	NOTES
1	Aluminium reduction tool	The arms on the structure needs more reinforcement as the heat started to softed up the thin steel arms holding up the structure tool down below. I will try to make simple shaped and cast therafter. I'm not sure if I'll still need casting sand, but ill try with just to be safe.
1	Layer of casting sand	
1	Handfull of grinded dross	
1	10x10cm aluminium slab	

EXPERIMENT: SUCCESS

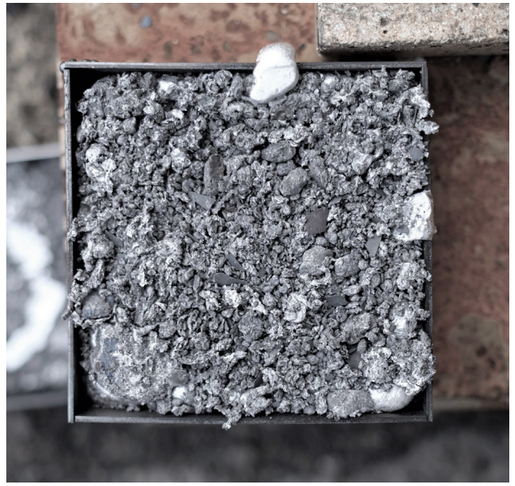
FRIDAY 06.11 | #17

THE RESULT ARE CONSISTENT!

I grinded it down to get a clear view of what the texture was like. and to my surprise it was pretty similar to my most succesful test yet. Not only will it be easy to obtain the wanted texture, but this also makes it a lot easier to get consistent results when casting other shapes.

QNT	INVENTORY LIST	NOTES
1	Metal grinder	Grinding down a slight layer off the top of the tests really brings out the contrast in the texture.
5	Sandpaper (240, 320, 800)	

EXPERIMENT: SUCCESS



TUESDAY 10.11 | #18

IN MOLD CASTING

I've been mold casting as I'm calling it a couple of times. This really seems like the way to get various textures with consistent durability. I've sliced all the tests up to see how well the dross and aluminium have blended and they all look it's pretty evenly distributed.

QNT	INVENTORY LIST	NOTES
1	Metal grinder	stiring the dross when the aluminium is molten will blend it, but it's hard to know if the dross has moved all to one side.
5	Sandpaper (240, 320, 800)	

EXPERIMENT: SUCCESS

THURSDAY 12.11 | #19

IN MOLD CASTING

The texture of this one really came out after grinding it down. It seems like grinding the top layer down will even out the border between the two materials

QNT	INVENTORY LIST	NOTES
1	Metal grinder	the picture showing the bottom side of the mold
5	Sandpaper (240, 320, 800)	

EXPERIMENT: SUCCESS

FRIDAY 13.11 | #20

MOLD CASTING

This texture was failry easy to create after doing the one from yesterday. It was just a bit more processing during burning.

QNT	INVENTORY LIST	NOTES
1	Steel stiring tool	Picture showing a top layer stired and grinded down.
1	Steel mold	
1	Handfull of casting sand	

EXPERIMENT: SUCCESS

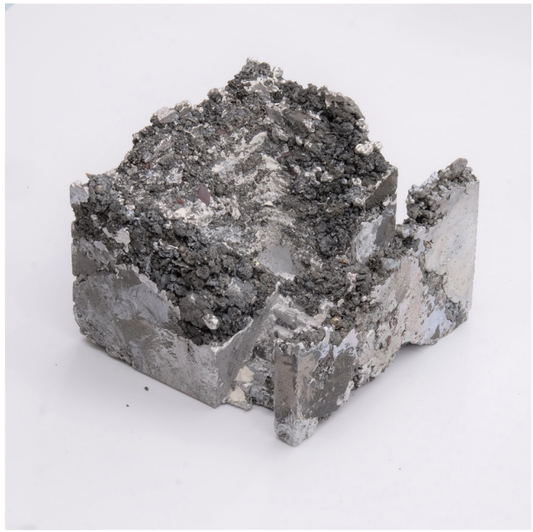
TUESDAY 17.11 | #21

DETAIL TEST 1

The lampshade mold was pretty straightforward, but as the date suggest it punctured on the last weld. The mold pictured on the right is how the final one came out. Filled it with dross and aluminium layers. Now I just have to wait for the rain to stop so I can cast it.

QNT	INVENTORY LIST	NOTES
1	3D print	The mixture ratio of dross and aluminium was too dross heavy
5	SUS/RSA mold	
2	handfull of dross	
400	g of aluminium scrap	

EXPERIMENT: FAILED/SUCCESS The model broke/found the limit



THURSDAY 19.11 | #22

DETAIL TEST 2

Fixed the ratio and it turned out much better. Grinded down the top three steps to see how deep the aluminium had penetrated. it was about 1-2mm which is not bad as the dross was still durable on its own.

QNT	INVENTORY LIST	NOTES
1	Steel mold	-
1	Casting sand	
700	g of aluminium scrap	
1	Handfull of grinded dross	

EXPERIMENT: SUCCESS

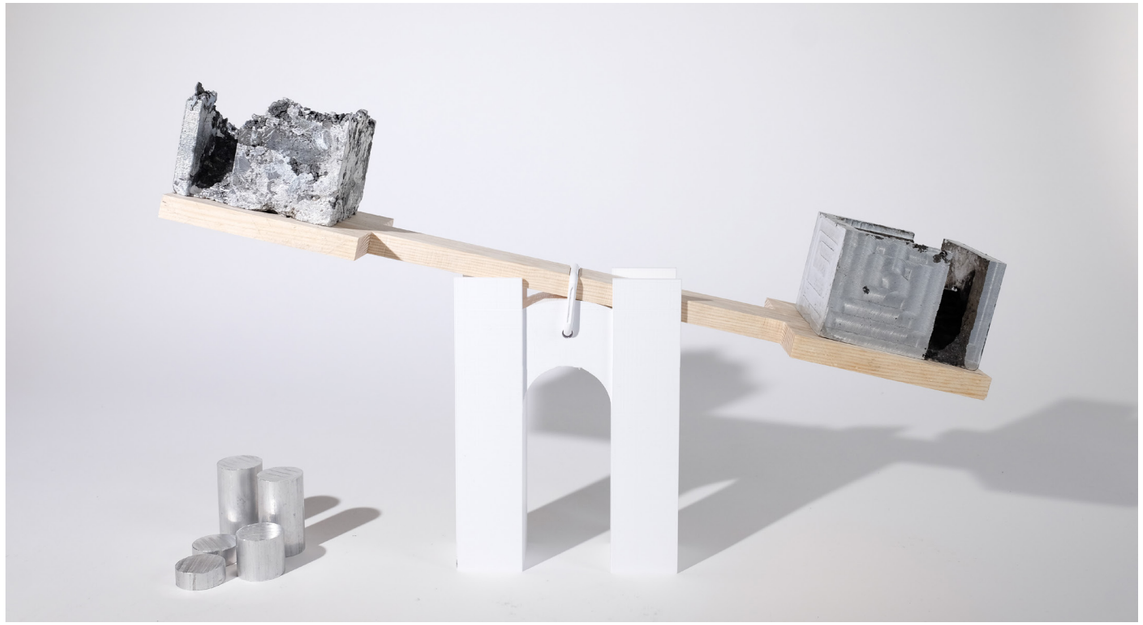
FRIDAY 20.11 | #23

COMPARING THE TWO LIMIT EXAMPLES

The obvious trait that differentiates the two is the out side layer. On the first, dross heavy, model the dross and aluminium have mixed unevenly and led to some weakpoints. The finely grinded dross and aluminium heavy showcaeses the details better, but the dross is less dominant so its a matter of opinion on what kind of model one is looking to cast. The three sizes of aluminium weights are 100g, 50g and 20g. It took 290g to counter the tests with lower dross ratio.

QNT	INVENTORY LIST	NOTES
1	Steel mold	Though the dross heavy test had some part of the back wall chipped off, the aluminium it took to counter it should still give a good representation of how dense the aluminium heavy version is.
1	Multi burned dross	
1	Scrap aluminium	

EXPERIMENT: SUCCESS



MONDAY 30.11 | #24

CREATING THE LAMPSHADE STEEL MOLD

The lampshade mold was pretty straightforward, but as the date suggest it punctured on the last weld. The mold pictured on the right is how the final one came out. Filled it with dross and aluminium layers. Now I just have to wait for the rain to stop so I can cast it.

QNT	INVENTORY LIST	NOTES
1	2D drawing to trace shape	The more upright (higher) a mold is the easier it is to blend - true or false?
5	Metal sheets	

EXPERIMENT: SUCCESS

TUESDAY 03.12 | #25

CASTING THE LAMPSHADE

Same procedyre as the no. 7 texture. The only thing that contridicted my theory was that I thought it was going to be easier to even out the dross and alumuminium with an upright mold as the large surface walls where so close that the dross had to be evenly mixed out to make room for the molten aluminium. What happened was that the dross became more buoyant as the preassure at the top and bottom were different. Not a big problem to counter, but now I know.

QNT	INVENTORY LIST	NOTES
1	2D drawing to trace shape	-
5	Metal sheets	

EXPERIMENT: SUCCESS

TUESDAY 04.12 | #26

ASSEMBLE OF LAMP

The

QNT	INVENTORY LIST	NOTES
1	2D drawing to trace shape	The more upright (higher) a mold is the easier it is to blend - true or false?
5	Metal sheets	

EXPERIMENT: SUCCESS