

The Making Of A Furnace

Written By Rob Boyko

The question is; Why make a furnace? These days, laboratory costs are expensive and can be as high as a few Hundred dollars or more. To make a furnace one has to have reason for it in the first place. For some it is a cost saving initiative, or an educational initiative, for others it maybe just because they can. Below is a copy of one of my receipts for lab analysis of only 30 grams of sample material. For me to make a furnace, it was a cost cutting measure, an educational initiative, and a method of double checking results (assay).

Canada

Project Code: 5124687
Shipment ID: 5124687-001
Quote Number:

Item	Package	Description	Sample No.	Unit Price	Amount
1	R200-250	Crush and Pulverize 250 g	1	\$6.85	\$6.85
2	G606	30g Pb collection fire assay	1	\$19.50	\$19.50
3	7AR2	1g AR Digestion ICP-ES	1	\$14.70	\$14.70
4	DIS-PLP	Warehouse handling of pulps	1	\$0.10	\$0.10
5	DIS-RJT	Warehouse handling of reject	1	\$0.25	\$0.25
6	BATCH	Batch Surcharge for <20 samples	1	\$50.00	\$50.00
Net Total					\$91.40
BC HST					\$10.97
Grand Total					CAD \$102.37

Invoice Stated In Canadian Dollars

As one can imagine, the cost of analysis can be quite high. With a furnace and a little know how, one can at least do some in house analysis. It is not rocket science. It only takes a little equipment and some laboratory supplies. Hence, I made my own furnace. It was a learning process to say the least.

So here it is. How I made my furnace. I needed to start off with some molds. It was my intention to use Sona Tubes. I started with a 16 inch tube for the outer circumference and an 8 inch tube for the inner circumference. The inner tube was cut a little shorter as I wanted to create a single body with a solid base (4 inches). That in itself was a mistake. I secured a base to the 8 inch tube and when I poured the concrete mix it collapsed. I ended up making the unit in three, not two pieces.



Inner



Outer



Lid

The concrete used was Cercast HT. It has a working temperature of about 3200 degrees F. It is a refractory cement that needed to be specifically mixed as per instructions or the mix would have degraded to not much more than concrete.



Cercast HT

TABLE NAME	BAG SIZE Lbs. (Kg)	Recommended W% WATER	WATER Vol. per Bag quarts (liters)
ICAST™ 18	55 (25)	9.0 - 11.0	2.4 - 2.9 (2.3 - 2.7)
ICAST™ 2400C	55 (25)	10.5 - 12.5	2.6 - 3.3 (2.6 - 3.1)
ICAST™ 2900	55 (25)	12.0 - 14.0	3.2 - 3.7 (3.0 - 3.5)
ICAST™ 3000	55 (25)	9.0 - 11.0	2.4 - 2.9 (2.3 - 2.7)
ICAST™ 3200	55 (25)	9.0 - 11.0	2.4 - 2.9 (2.3 - 2.7)
ICAST™ 3300	55 (25)	8.0 - 9.0	2.1 - 2.4 (2.0 - 2.3)
ICAST™ B LI	55 (25)	9.0 - 11.0	2.4 - 2.9 (2.3 - 2.7)
ICAST™ FP-P	3000 (1360)	6.4 - 7.2	92.0 - 103.5 (87.1 - 98)
ICAST™ HT	55 (25)	10.0 - 12.0	2.6 - 3.2 (2.5 - 3.0)
RAX™ G1700	55 (25)	7.5 - 8.5	2.0 - 2.2 (1.9 - 2.1)
IRA-CAST® 28	55 (25)	11.4 - 12.0	3.1 - 3.3 (2.9 - 3.1)
IRA-CAST® 30	55 (25)	9.5 - 10.5	2.6 - 2.9 (2.5 - 2.7)
DRECON™ 3000	55 (25)	11.0 - 12.0	2.9 - 3.2 (2.7 - 3.0)
DRECON™ 3200	55 (25)	9.0 - 10.0	2.4 - 2.6 (2.3 - 2.5)
DRECON™ 85	55 (25)	8.0 - 9.0	2.1 - 2.4 (2.0 - 2.3)
DRECON™ NW	55 (25)	14.0 - 15.0	3.7 - 4.0 (3.5 - 3.7)
DRECON™ TABCAST	55 (25)	8.0 - 9.0	2.1 - 2.4 (2.0 - 2.3)

Mixing Instructions

After the cement was mixed, one has about 15 minutes to have it poured. This material starts to harden within 15 minutes and becomes difficult to work with. As I mentioned, I had to create a base as the centre tube base collapsed on me during pouring. That was my first mistake. The cost per 55 lb. bag is about \$75.00. I used 5 bags.



The dry powder



The mix



The first pour



The collapse



The base



The lid

After every piece hardened and cured (48 hours), they were ready to assemble. The hole for the burner at this point has not been drilled.



The completed unit

The next phase of this project was to build the burner. I needed this to be a propane burner capable of producing a temperature of more than 3200 degrees F.

I looked at a lot of designs but chose an old design that was used in the early 1900's / late 1800's. To build this burner I used some gas piping (10 inch X 3/4 threaded gas nipple cut to 8 inches to eliminate the threaded portion on one end).

I precut and drilled a 3/8 inch hole in the centre of a 1 inch to 3/4 inch reducer. I press fit into place a 3/8 inch brass nipple into the reducer and further press fit a 0.035 welding tip orifice into the nipple. I then added a gas valve, 6 feet of propane flexible gas line hose, and a 5 to 35 psi regulator which connected to a propane tank.



The cut section of the burner and fitting of the nipple



The welding tip assembly



The completed burner

During testing of the burner I had to do some additional cutting of the burner (reducer) to get the right air flow in the combustion tube. I made two test burns prior to drilling the hole in the furnace for this burner. The first test was made during the day. The second was at night. The flame was so hot during the day burn test; you could not see the flame, only the vapors. The camera did pick up on the flame as shown in the next photo's. The regulator is set to 15 psi.



Day test burn



Test burn at night. Flame is 2 Ft long



Flame in burn chamber

The test burns were successful and a hole was drilled into the furnace. This completed the making of the unit. As of this writing, I still need to find a type "R" pyrometer before I drill one more hole. The second mistake made was not adding a stainless band around the body components of the furnace. The test burn of the completed unit did cause a crack, as expected, within the body and lid of the unit but did not cause any degrading issues. The burn worked well and the only issue was the making of the pedestal for the crucibles. This has been completed by using a sour cream container for the mold. It worked better than expected.



The pedestal

And here it is the finished product. The next furnace that I build will be a smaller unit. I want to figure out a better way of creating the molds without using Sona Tubes (Cardboard).



The finished project

The next thing to do is use it to roast the water and sulphides out of the samples that I collected from my Moncton creek project. A video of the operation of the furnace can be viewed at:

<https://youtu.be/SEwtSMm8vy4>

I Hope that you find this article interesting as well as the posted video that goes along with this article. If you wish, leave me a message from my contact page at www.BoykoMineralExploration.com and lets start a conversation.