

Crucible Melts in an Electric Furnace: Glass Melting Procedure

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Overview:

Melting of 500g batches of soda lime glass at 1500° C in an electric furnace. Annealing at 1°/min. Time required: 5 hours of furnace time [2 h batch addition period, 3 h melt] plus batch preparation and post-melt clean-up. Overnight annealing.

Safety and Equipment:

Safety Hazards: High temperature, hot molten glass, electric voltage.

Equipment Hazards: Please make every effort not to spill molten glass or batch on furnace refractories. Do not allow glass to overflow the crucible! Replacement parts are expensive and custom made. If glass drips down the side of the crucible, do not put it back in the furnace, start over. If a spill occurs, cool furnace and chisel out vitreous spill and patch with suitable material [alumina, zirconia, fireclay] before resuming. Furnaces are electrical appliances, be aware of electrical hazards as appropriate.

Composition: The following procedure is for standard soda lime silicate glass formulations ONLY. Other compositions, such as highly fluxing fluoride or alkali compositions may dissolve the crucible and ruin the furnace in the times and temperatures given.

Materials and Equipment:

- Bottom load furnace capable of 1600° C
- 500 g of mixed glass batch in a glass jar
- Fused silica crucible, 250 ml or greater.
- Tongs, gloves and safety glasses
- Metal plates and molds as desired for pouring glass
- Annealing oven, capable of 600° C with programmable controller.

Procedure:

- Preheat furnace to **1400°**.
- Fill cold crucible one-third full with glass batch, less if batch is known to be foamy.
- Place one-third filled crucible in the furnace and start recording time. This is t=0
- At t=40 minutes, add batch, only filling one-third of the remaining available crucible volume.
- At t=1:10, add batch, only filling one-third of the remaining available crucible volume.

- At t=1:40, add batch, only filling one-third of the remaining available crucible volume.
- At t=2:00, add batch, only filling one-third of the remaining available crucible volume. [All batch should be charged now. If not, contact instructor and review procedure]
- Increase furnace temperature to 1500°.
- Turn on the annealing furnace and set at **580°**
- At t=3:30, remove the crucible from the furnace and stir the glass
- At t = 5:00, pour the glass into the desired shapes.
- Quickly, before cooling, place the glass into the annealing furnace
- Program the annealing furnace as follows:
 - 580 soak, 15 minutes
 - 580 – 450 ramp, 1 degree per minute
 - 450: Shut off furnace and allow to cool at natural rate.
- Reset melting furnace controller to hold at 1200°.

=====Note dark glasses=====

Two types of specimens should be prepared during pouring:

1. A standard as-poured disk. Pour sufficient glass on a metal surface to form a disk approximately 8 – 10 cm in diameter and about 6 mm thick.
2. A pressed specimen. Pour a 5 cm disk on a warm steel plate and immediately press it with a second warm steel plate. Target is to achieve glass thickness of about 3 mm.