

Crystallization of Sucrose with Different Humidity

Jung Hyun Noh

Bethlehem Catholic High School

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Outline

My project is about studying (measuring) how sugar glass forms crystals at it's surface in moist conditions. I present data on the rate of formation of surface crystals on my sugar glass samples.



Introduction – **What is a Glass**
Properties of glass
Examples of glass

- hard candy as an example of a glass

**Concept of glass as an intermediate,
Metastable “state” of matter.
Crystallization**

Hypothesis

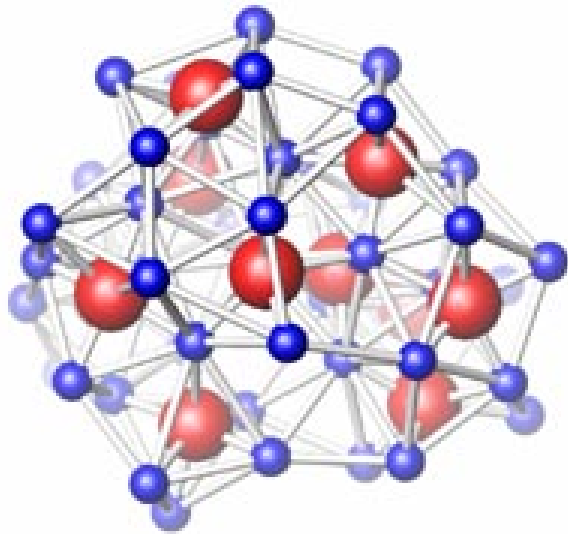
Procedure - **How I Made Sugar Glass**
Crystals growing from Sugar Glass
My Method of studying Crystal Growth

Results (Data) – **Result1 and Result 2**

Conclusion - **Summary and Future Plans**

What is a Glass?

- Structure of Glass



- Examples of Glass

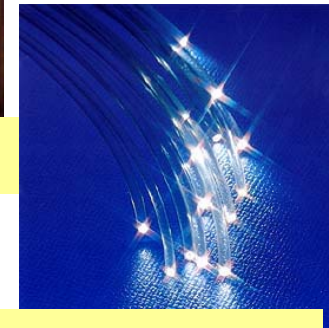
Water glasses



lenses



Window pane



Optical fibers

bottle



Properties of Glasses

- Brittle
- Often clear or transparent
- Can be molded and shaped when soft (torch)

Candy is a Glass!

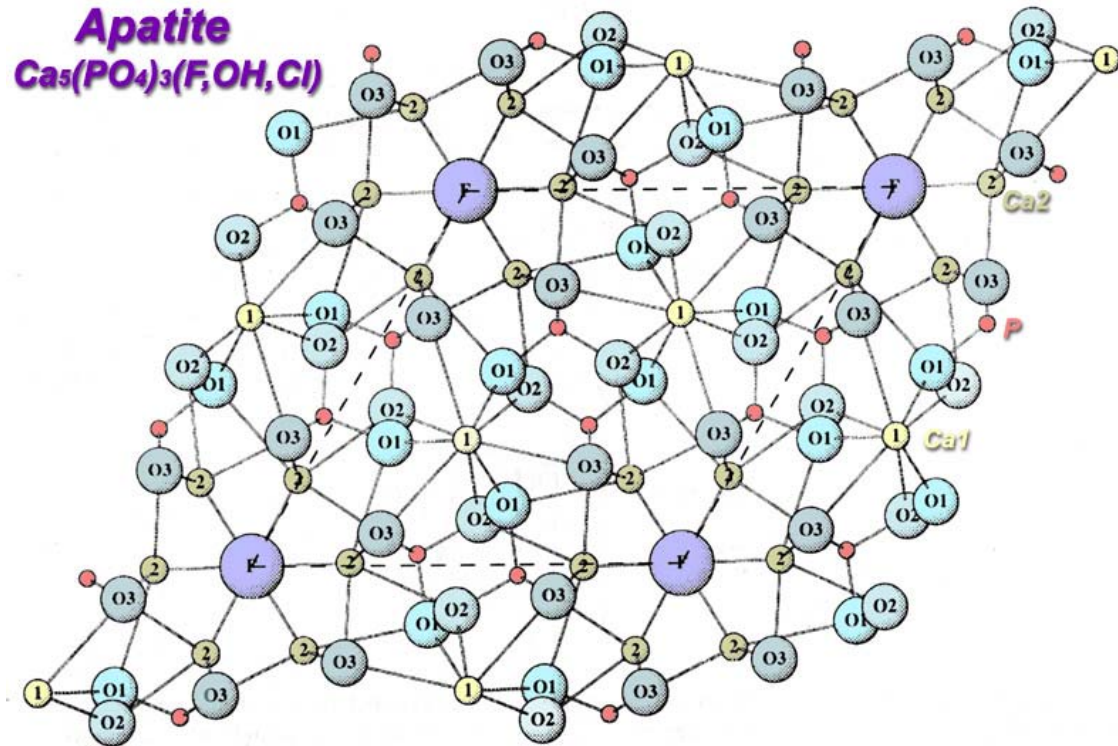
- Clear
- Brittle (when cracking with a hammer)

State of Matter

- Solid
- Liquid
- Gas

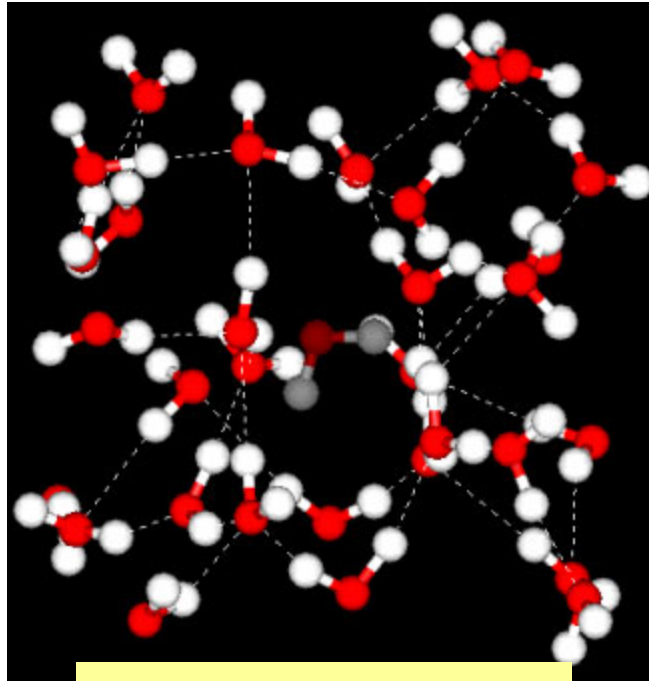
Crystallization

- Nucleation
- Crystal Growth
- Structure of Crystal



Structure of crystallization

Structure of Liquid ... Let's compare!



Structure of liquid

Hypothesis

- **What causes Crystallization?**
- **Which humidity is good for crystallization?**

I thought...

**Humidity causes
Crystallization,**

**but I thought 100%
crystallization would be a
good for crystallization.**

How to make sugar glass?

- Making glass



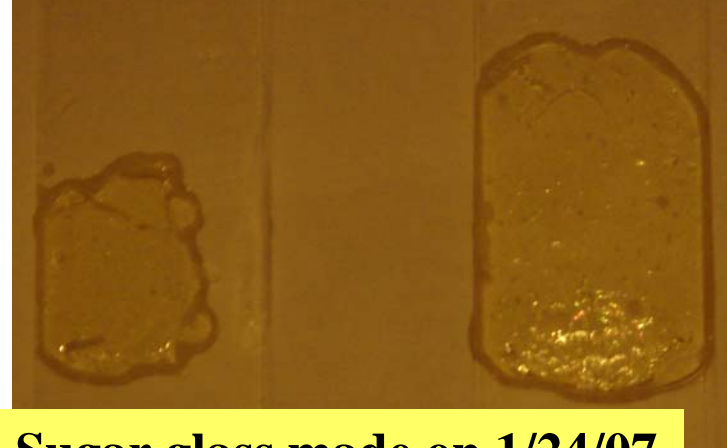
Recipe

- **Recipe 1 :**
- 1.5 cup “Domino” cane sugar (sucrose) (142gm)
- 1/4 cup “Karo” corn syrup (82gm)
- 1/4 cup water(60 gm)
- **Recipe 2 :**
- (1.5 cup cane sugar(sucrose) – 190 gm
- 1/8 cup Karo corn syrup – 41 gm
- 1/4 cup water – 60 gm)

Let's put the glass on the slides!



My samples to study crystal growth
Originally no crystals – only glassy candy

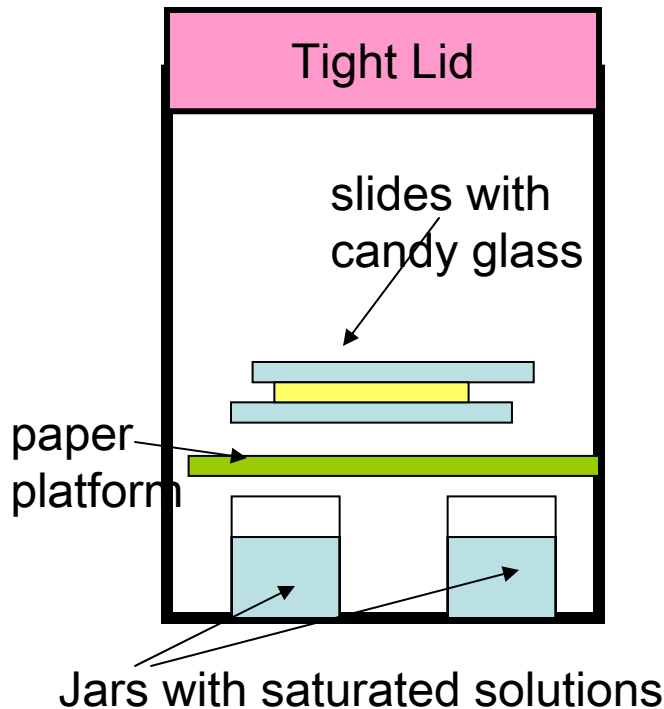


Sugar glass made on 1/24/07

Let's put the glass on slide glasses!

Make Humidity Chambers!

Humidity 50% chamber

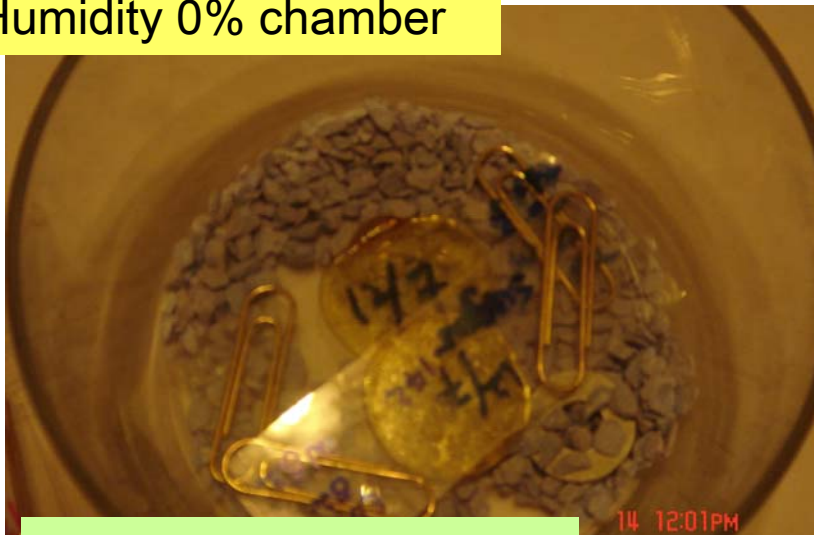


$\text{Mg}(\text{NO}_3)_2$ + water) for 50% RH

For 0% (dry) use desiccant CaSO_4
For 100% RH use wet paper towel

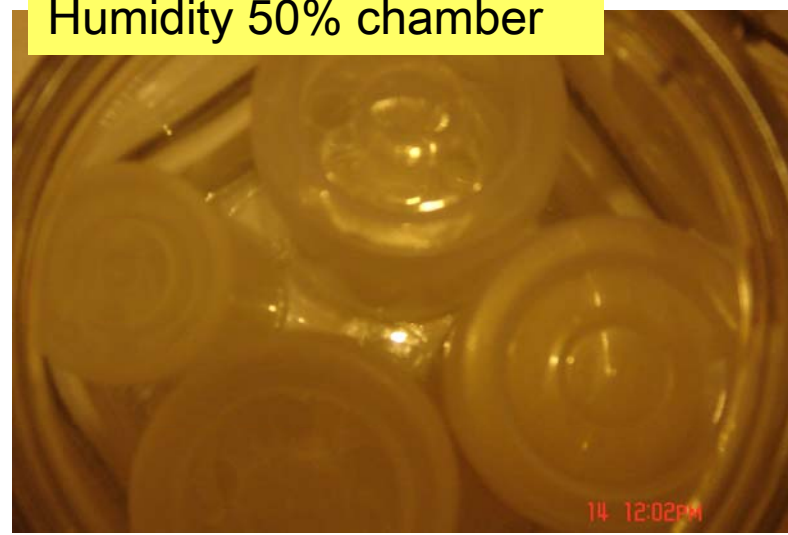
Top View of My 3 Chambers!

Humidity 0% chamber



With desiccant, CaSO_4

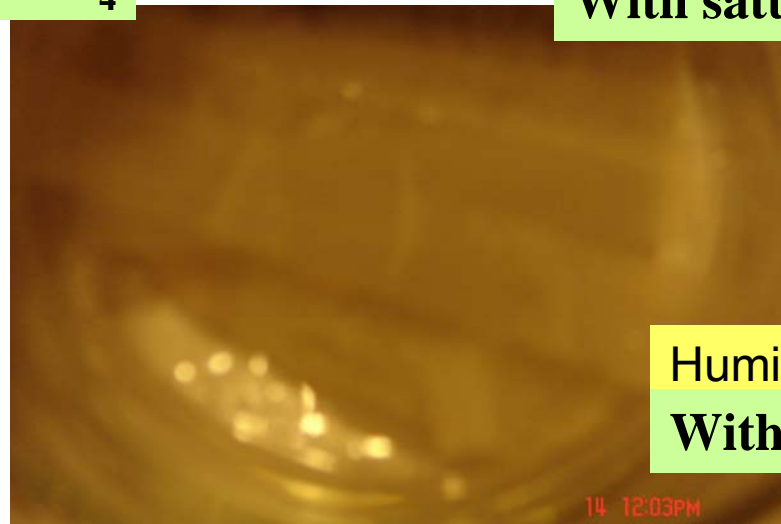
Humidity 50% chamber



With saturated $\text{Mg}(\text{NO}_3)_2$ solution

Humidity 100% chamber

With soaked tissue in water

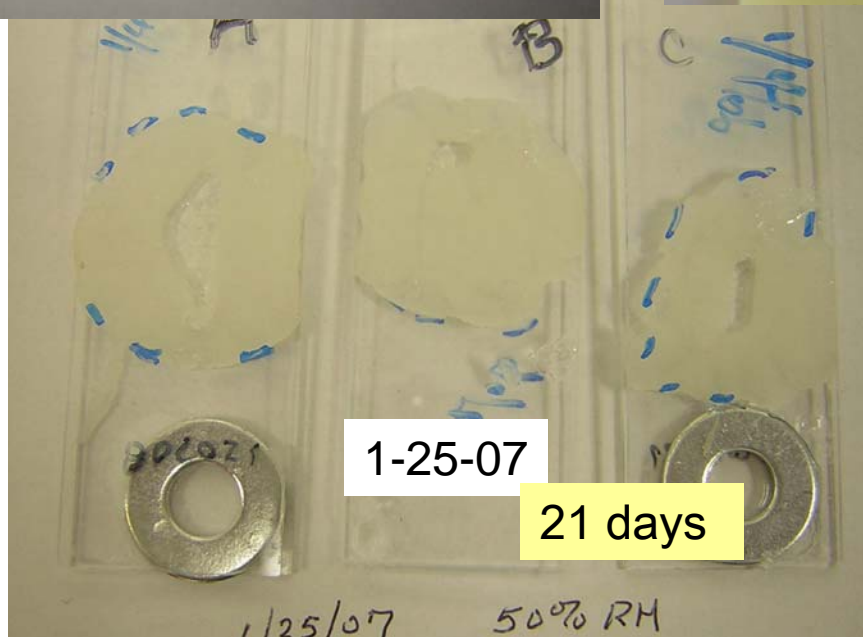
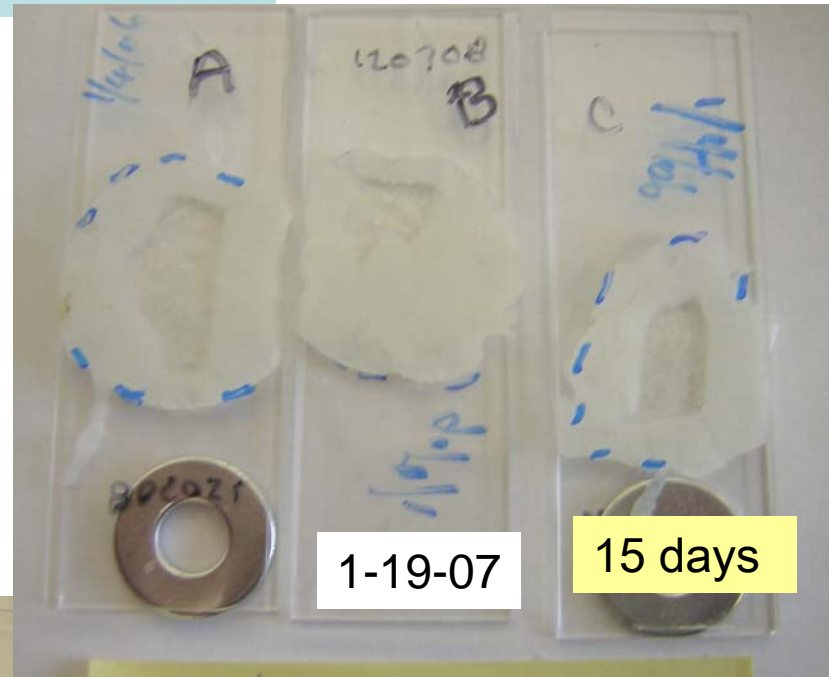
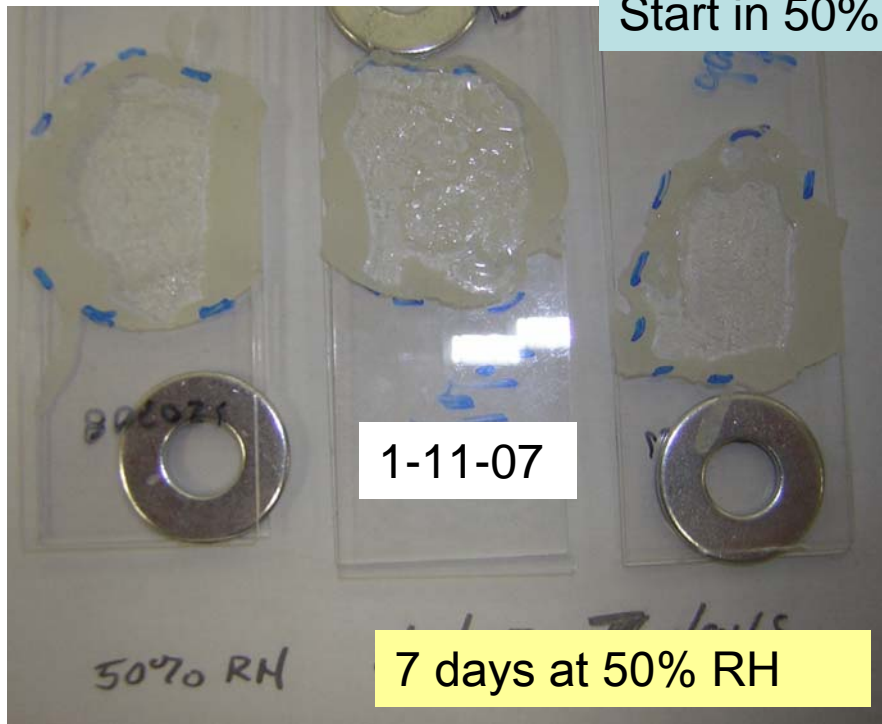


Nothing happens in 0% RH

Crystals grow in 50% RH

What happens in 100% RH

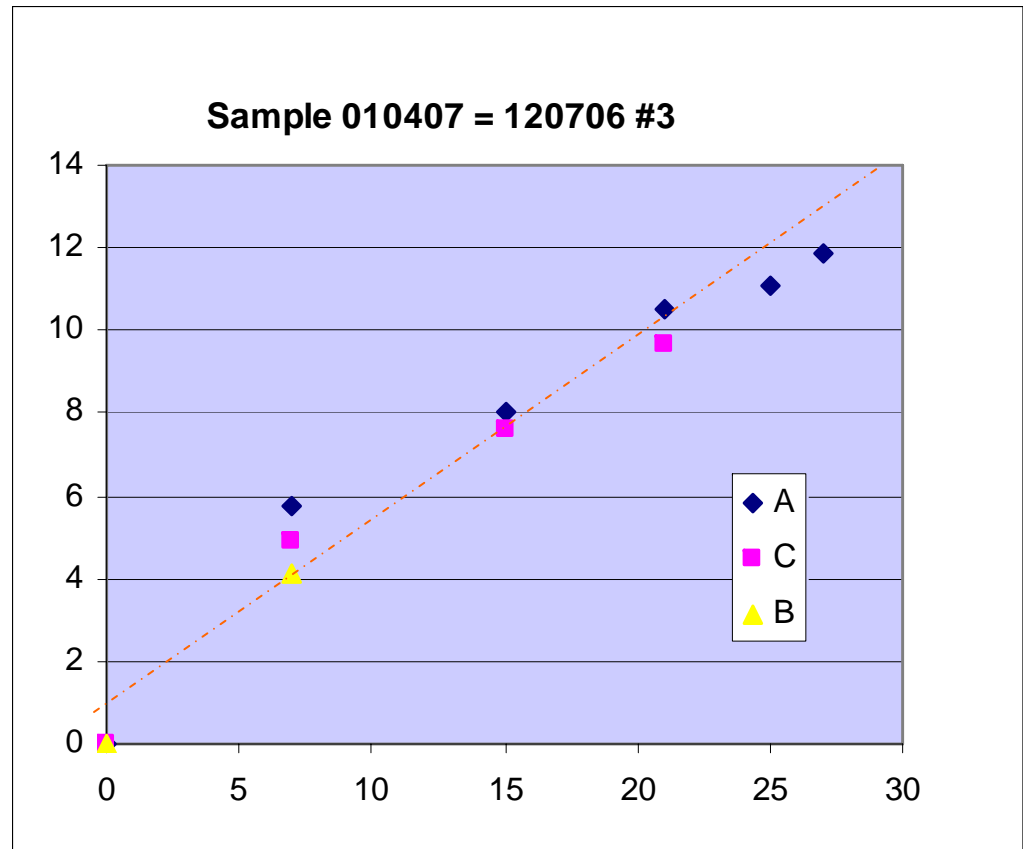
Start in 50% Rh on 1/04/07



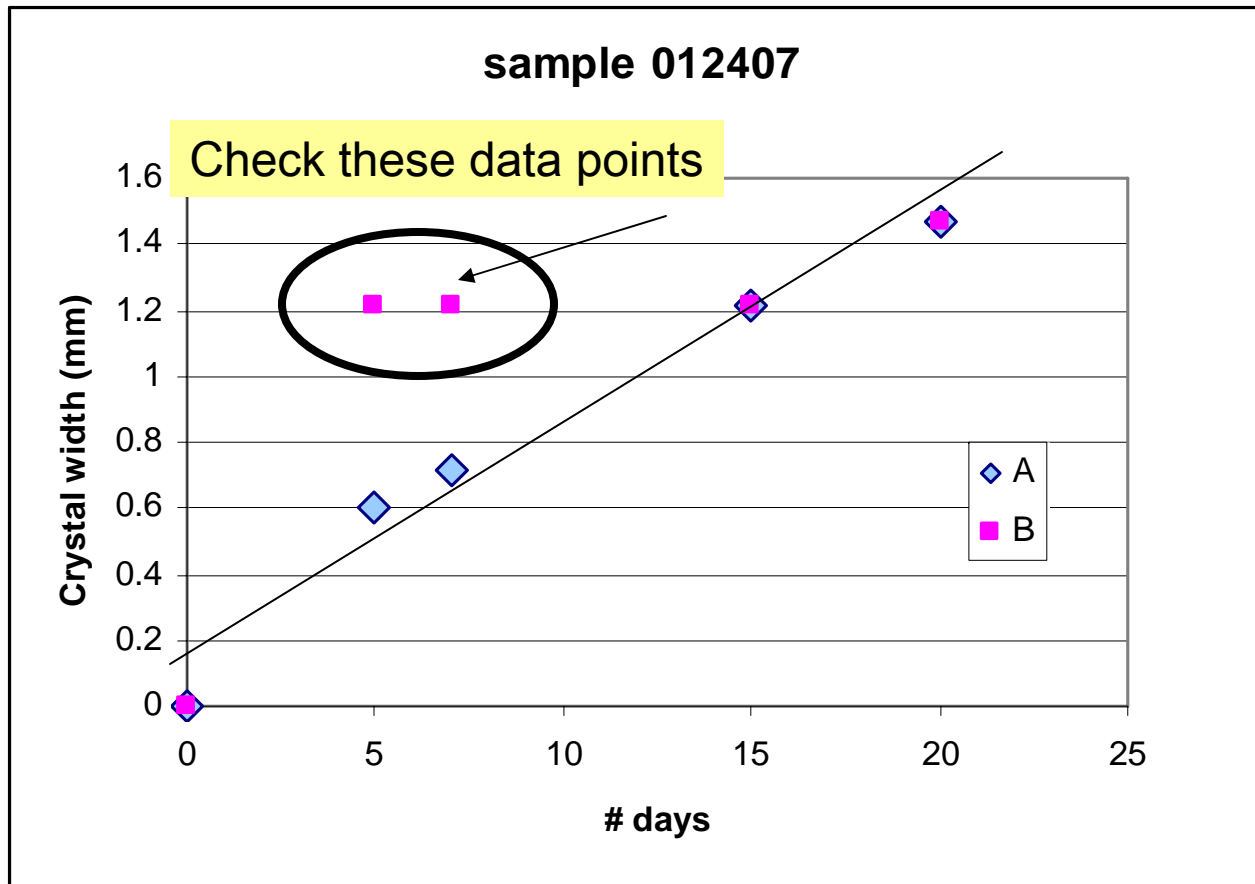
My First Sugar Glass Samples

Sample 10407

days	Crystal Widths (mm)		
	A	C	B
0	0	0	0
7	5.74	4.92	4.1
15	8.02	7.58	filled area
21	10.51	9.63	
25	11.07	filled area	
27	11.85		



My 2nd attempt



Summary

I have measured the rate at which sugar glass crystallizes with time. I have shown that the rate is very humidity dependent and extremely slow when dry. Using humidity controlled chamber I was able to measure the actual growth rate for the 50% humidity.

Future Plans

I would like to measure crystal growth rate at other compositions and even study the effect of temperature.