Name_____
Date_____PER____

Stoichiometry of the123 YBCO

Purpose: To stoichiometrically produce 30 grams of superconducting 123 YBCO

Balance the given equation

$$__Y_2O_3 + __BaCO_3 + __CuO \rightarrow __YBa_2Cu_3O_{7-x} + __CO_2$$

Balance the given equation, assuming that you want 1MOLE of $YBa_2Cu_3O_{7-x}$

$$__Y_2O_3 + __BaCO_3 + __CuO \rightarrow YBa_2Cu_3O_{7-x} + __CO_2$$

PRELAB:

Name each of the following:

Y_2O_3 _____ $BaCO_3$ _____ CuO _____

Starting with 30 grams of $YBa_2Cu_3O_{7-x}$, show how many grams you will need of each reactant.**(You must show all your work)**

Add each of the individual final reactant amounts_____

Does this value equal 30 grams? If not, account for this increase or decrease.

Procedure:

1.Using a mortar and pestle grind together very well (at least 10-15 min.) until the powder is a uniform grey color. Be very careful not to get carried away with grinding and spill your reactants onto the bench top.

2.To help insure all the reactants are thoroughly ground together, periodically use a spatula to scrap the sides of the mortar removing any caked-on powder, and continue grinding until the uniform grey color is achieved.

3.Transfer the powder to a porcelain crucible. Identify your crucible using a clay lab pencil or sharpie marker.

4.Place your crucible in a furnace (uncovered) with the other groups. The lab assistant will set the temperature to 930°C. It must be kept at this temperature for 12 h or longer.

5.Therefore, a lab assistant will turn off the furnace and allow the sample to cool slowly in the furnace at the appropriate time. This slow cooling allows atmospheric oxygen to be taken up by the sample and produces the desired oxygen content. The crucible may be removed when the temperature is below 100°C.

DAY 2

1.Obtain your group's crucible from the dessicator.

2.The black mass can be gently dislodged from the crucible. Regrind your sample in a clean mortar until a fine black powder is achieved. The black mass can be very hard, so do this carefully. It is not pertinent that the sample is finely ground, but the finer it is, the better pellet it will make in the press.

3.Once the powder is prepared, the sample can be checked to see if the superconducting phase has actually been produced. Place your ground black product in the pellet press.

4.To do this, close off the flush end of the die with the shorter "cap" mandrel.

5.Pour the sample mixture into the center. Insert the other much longer mandrel in the barrel and rotate it several turns with slight pressure to distribute the powder evenly.

6.Holding the die carefully between both hands, place the assembly in the hydraulic press. Pump down to between 6000 and 7000 psi. Leave the die in the press under this pressure for at least 2 minutes. Release the pressure and carefully remove the die.

7.Using the "half pipe" and rubber mallet gently tap the die apart releasing your pellet. It is advisable to do this over a clean sheet of paper or something suitable to catch any powder if your pellet didn't form well or breaks apart. If this is the case, fully regrind your sample and press it again.

8. Measure the mass of your 123 YBCO pellet.

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9. Once a suitable pellet is formed, place it in the bottom of a Styrofoam cup that has had the bottom cut out. Cool your pellet by carefully pouring liquid nitrogen over it, enough to fill up the lip of the cup.

9.Wait approximately 10 seconds for the pellet to reach liquid nitrogen temperature (when the bubbling stops) and proceed to place a very strong magnet over your pellet. I

10. If the superconducting phase has been produced, the magnet will levitate above the surface of the pellet as long as the sample stays at liquid nitrogen temperatures. This phenomenon is known as the Meissner effect.

Calculate the % difference between your experimental mass and your desired mass

$$\frac{\left|Mass_{\exp} - Mass_{desired}\right|}{\left|Mass_{desired}\right|} x100$$