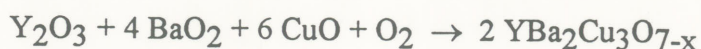


I. Preparation of $\text{YBa}_2\text{Cu}_3\text{O}_{7-x}$

$\text{YBa}_2\text{Cu}_3\text{O}_{7-x}$ will be prepared by sintering a pellet containing Y_2O_3 , BaO_2 , and CuO . The pellet is heated to 930 C to form bonds among the constituents, and then cooled to 500 C to allow reaction with oxygen to obtain a nonstoichiometric compound with $x \approx 0.1$. The reaction (with only the metal ions balanced) is given by:



Precautions

Barium salts are toxic. Before handling the compounds, read over the Materials Safety Data Sheets in the Appendix. Wear a lab coat, vinyl gloves, and goggles; dust masks are also available. Avoid creating or breathing dust. Avoid eye contact and excessive skin contact. With the exception of the pellets, handle all materials in the laminar flow hood. Wash hands thoroughly after handling. Dispose of waste pellets and powders in the specially marked waste bottle. Contaminated weighing paper, gloves, etc. should be placed in the trash can beside the laminar flow hood. **Clean up your mess!**

Calculate the weights of BaO_2 and CuO required to react stoichiometrically with 0.30 g of Y_2O_3 to produce $\text{YBa}_2\text{Cu}_3\text{O}_{7-x}$. Weigh out the compounds on folded weighing paper, and transfer to a small, dry beaker. Mix the compounds with a spatula and transfer to the mortar. Mix and grind with a pestle for about 10 minutes, periodically scraping the caked material off the sides of the mortar with the spatula. The final mixture should be uniform gray in color, with no black or white spots or streaks visible, and no large particles.

Scrape the mixture out of the mortar onto a folded piece of weighing paper. Check the punch and die of the pellet press for cleanliness, and clean as necessary. Make a pellet from the mixture using the following procedure, which is described with illustrations in the Parr pellet press notes in the Appendix:

- **Fill the die.** Set the die into its holder, with the beveled edge of the die cavity facing upward, and with the bottom of the die resting on the flat surface of the reversible holder. Pour the powder mixture into the die cavity. Tap the holder gently on the bench to settle the powder.
- **Compress the powder.** Place the die and its holder in place on the anvil of the press. Push the lever down to compress the powder into the pellet. *Don't push too hard!* The lever should require a firm push as it moves through its full stroke. If a full stroke is not obtained with reasonable force, rotate the anvil to lower the die slightly. If the lever moves through the full stroke without encountering sufficient resistance, rotate the anvil to raise the die slightly.