Thermite Reaction

Purpose

To demonstrate a spectacular exothermic reaction that produces enough heat to produce molten iron.

Materials

2 clay flower pots (6.5 cm diameter with 1.0 cm hole in bottom)

filter paper

spatula

heat resistant gloves

ring stand / ring

ferric oxide powder

aluminum powder

potassium permanganate

glycerin

dry sand in large flower pot

Procedure

1. Place a piece of filter paper over the bottom opening of clay pot #1.
2. Place clay pot #1 into clay pot #2.
3. Mix 50 grams of Fe_2O_3 powder with 15 grams of aluminum powder.
4. Place the mixture into clay pot #1 and form a small cone-shaped indentation in the center of the mixture (about 2.0 cm deep and 1-2 cm wide).
5. Just before preforming the demo, grind 25 grams of $KMnO_4$ crystals to a powder and fill the indentation with the powder.

6. Form another small cone-shaped indentation in the permanganate powder.
7. Place the two clay pots inside an iron ring clamped high on the ring stand and place the container of sand on the ring stand base below the clay pots.
8. Place 5-6 mL of glycerine in a small beaker.
9. Pour the glycerine into the depression formed in the $KMnO_4$ crystals. Step back immediately. Ignition will occur in 15-60 seconds.
10. If the reaction fails, wait 1-2 minutes after the initial flare from the glycerine-$KMnO_4$ reaction. Add more glycerine and potassium permanganate.
11. Flame, flying sparks, smoke and dust are produced. Molten iron will run through the hole in the pot into the sand bath.

Additional Information

1. Perform the demonstration outdoors unless a large, well, ventilated room is available. The reaction produces a tremendous amount of smoke.
2. Sparks may be thrown two meters vertically and up to five meters horizontally. Use a safety shield.
3. A most spectacular demonstration but great care is required. Try this demonstration alone prior to performing before a group.
4. Never drop the iron into water or wet sand. A steam explosion can result sending hot iron into the audience.
5. A variation involves using commercial thermite/starter material.
   a. Fill the small clay pot ¼ full with thermite powder followed by a thin layer of thermite ignition mixture.
   b. Mix 1.0 gram of potassium chlorate and 1.0 gram of granulated sugar and pour the mixture on the flattened top of the thermite/starter material.
   c. Form a small depression in the top of the sugar-$KClO_3$ mixture.
   d. Add 1 or 2 drops of concentrated sulfuric acid to the depression and step back.
   e. Within seconds, a flame is produced, followed by sparks and smoke. Solid iron with aluminum oxide remains on the ring stand.

   NOTE: Do not set this version up more than one hour in advance.

Disposal

After they have cooled, the flower pots can be collected and written up with UI# 214624.

Reference

Shakhashiri, Bassam; Chemical Demonstrations, Volume I, 1983.