4.1 Burning Magnesium

Subjects: Chemical reactions, combustion, stoichiometry/limiting reagent, oxidation, thermodynamics

Description: A combustion reaction is demonstrated by the burning of magnesium in air, emitting a brilliant light and intense heat.

Materials:
Magnesium ribbon
Meeker burner*
Tongs
Matches, butane lighter*, or spark gas lighter*

*Burner and lighters are located in the top drawer opposite the bin storage shelves.

Procedure:
1. Light the burner and adjust to a blue light.
2. Holding the strip of magnesium metal with the tongs, place one end of the ribbon in the flame.
3. Remove the ribbon from the flame once it ignites and hold it away from you.

Discussion:
Magnesium is being oxidized by the O_2 in the air to magnesium oxide*. This is a highly exothermic combustion reaction, giving off intense heat and light. The reaction of the combustion of magnesium in oxygen is given below:

$2Mg(s) + O_2(g) \rightarrow 2MgO(s)$

The stoichiometric factor is 2 moles of magnesium are burned for every 1 mole of oxygen (2mol Mg/1mol O_2). If the magnesium strip weighs 1 gram, then there is 0.04 mol of magnesium (1 gram divided by 24.3 grams/mol Mg) available in the reaction. The amount of oxygen required to completely react with the magnesium strip is:

0.04 mol Mg x (1 mol O_2 / 2 mol Mg) = 0.02 mol O_2 x 16 g/mol O_2 = **0.32 gram O_2**.

The magnesium will burn until consumed entirely. There is much more oxygen available in the atmosphere than needed to consume the magnesium. Thus the magnesium is the limiting reactant because it determines the amount of product formed.

***Note:** Production of magnesium oxide is the dominant reaction. Magnesium also reacts with nitrogen in the air to produce some magnesium nitride (Mg3N2).
$3\ Mg(s) + N_2(g) \rightarrow Mg_3N_2(s)$

Safety: Do not look directly at the burning magnesium due to the intensity of the light. A dry-powder fire extinguisher should be available.

Disposal: Once cooled the solid magnesium products can be thrown in the trash

References:

1. B.Z. Shakhashiri. *Chemical Demonstrations: A Handbook for Teachers of Chemistry*; Wisconsin; 1983; Volume 1; Pages 38-39