

Zinc Thickness in Galvanized Iron

Lab 32 APPLICATION

Text reference: Chapter 11

Introduction

How much water can a rusty bucket hold? None. When a bucket gets rusty, the rust flakes off, leaving holes and leaks behind. The corrosion, or rusting, of iron has had great economic impact on the construction and automotive industries. A number of methods have been developed to prevent rust formation. The most expensive is the alloying of nickel and chromium with iron to make rust-resistant stainless steel. Other methods use a series of nonmetallic coatings to slow the formation of rust. These methods are widely used in the manufacture of automobiles. Another method that has been in use for a long time is galvanization, or coating of iron with a thin layer of zinc. Since zinc is oxidized more easily than iron, it forms zinc oxide, which stays firmly in place and continues to protect the iron for a long time. Unfortunately, even galvanized iron eventually disintegrates, so that the bucket eventually rusts and leaks despite this preventive effort.

Since zinc is more expensive than iron, it is cost effective to use the thinnest coating of zinc possible. How much zinc is involved in such a process? In this investigation, you will determine the thickness of the zinc coating on a piece of galvanized iron. You will start by determining the mass of the zinc on a piece of iron. You will then calculate the thickness of its coating.

Pre-Lab Discussion

Read the entire laboratory investigation and the relevant pages of your textbook. Then answer the questions that follow.

1. What is meant by the term corrosion of metals? _____

2. What is galvanized iron? _____
3. How will the thickness of the zinc coating be determined in this experiment? _____

4. What precautions must be taken in performing this experiment and why? _____

Name _____

Problem

How do you determine the thickness of zinc on a piece of galvanized iron?

Materials

chemical splash goggles
laboratory apron
rectangular piece of galvanized
iron
laboratory balance
metric ruler

latex gloves
beaker, 250-mL
hydrochloric acid (HCl), 6.0 M
tap water
paper towel



Safety



Wear your goggles and lab apron at all times during the investigation. Hydrochloric acid is corrosive and can give off hydrogen chloride fumes when heated. Use in a well-ventilated area, preferably under a hood. Wear gloves when using 6.0 M hydrochloric acid. Note the caution alert symbols here and with certain steps of the Procedure. Refer to page xi for the specific precautions associated with each symbol.

Procedure



1. Put on your goggles and lab apron. Determine the mass of a piece of galvanized iron and record it in the Data Table.
2. Measure the width and length of the galvanized iron and record these values in the Data Table.
3. Put on your gloves
 Place the galvanized iron in the 250-mL beaker and cover with 30 mL of 6.0 M hydrochloric acid (HCl). **CAUTION:** Hydrochloric acid is corrosive and can give off hydrogen chloride fumes when heated. When the rapid evolution of gas stops, add water to the beaker and then pour off the liquid into a beaker your teacher has provided. Rinse the remaining metal with tap water and dry it with a paper towel.
4. Determine the mass of the remaining metal and record it.
5. Clean up your work area and wash your hands before leaving the laboratory.


Name _____

Observations (sample data)

DATA TABLE

mass of galvanized iron (g)	
mass of remaining iron (g)	
mass of zinc (g)	
length of metal, l (cm)	
width of metal, w (cm)	



Calculations (based on sample data)

1. Find the area of iron covered by zinc (remember zinc covers both sides of the piece).
2. Find the mass of the zinc coating.
3. Given the density of zinc as 7.14 g/cm^3 , find the volume of zinc.
4. Find the thickness of the zinc coating.
5. Given the diameter of the zinc atom as $2.66 \times 10^{-8} \text{ cm}$, find the thickness of the zinc coating in atoms.

Critical Thinking: Analysis and Conclusions

2. How did you know that the zinc had fully reacted with the acid?
(Interpreting data) _____
