Float a Metal Boat

Introduction

If you take a penny and put it in water, does it float? How about a metal key — would *that* float in water? The answer to both questions is no — but we all know that metal boats are able to float, from small canoes to large ships that carry people and cargo. Why do metal boats float, but metal pennies and keys do not? It has something to do with density. Density is defined as mass per unit volume, and it is affected by the size and the shape of an object. Let's see if you can make a metal boat that successfully floats a large number of pennies!

Materials

- aluminum foil
- scissors
- about 50 pennies
- tape
- lots of cloths or paper towels
- large containers that will hold water, filled approximately an inch deep
- water

Safety Suggestions

- Do not eat or drink any of the materials used in this activity.
- Thoroughly wash hands after this activity.
- Be careful not to have accidents with the scissors.
- Be careful not to spill water on the floor because it will be slippery.

Goals

1. Make an aluminum foil boat that will float.
2. Float as many pennies in the boat as you can before it sinks.

Procedure

1. Cut one or more squares of aluminum foil, each approximately 5-6 inches (13-15 cm) square.
2. Fold the foil squares into creative boat shapes, using tape if necessary. Try different shapes and side heights.
3. Carefully float the boat in a container of water. Does it float?
4. Carefully add one DRY penny at a time, taking care to add pennies to alternate sides of the boat so the load is balanced. Add pennies until the boat sinks, and record the number of pennies that were able to float. The penny that sank the ship doesn't count.
5. Try the experiment using each of the different foil boats you made. Which one was able to float the most pennies?

How does it work? Where's the chemistry?

Metals do not dissolve in water, and objects made from metal can be watertight if all seams are sealed. Even though metals like coins seem too heavy to float, they actually can — but only if the metal atoms are spread out over a large enough area. Metal boats can float when their density (which is defined as mass per unit of volume) is less than that of water. In addition, the shape of the boat is very important. A flat bottom is best, with sides to keep out the water and a large surface area that touches the water. Boats with lots of surface area are very wide, with lots of space inside. When pennies are added, the boat will float if the combined density of the pennies and the boat is still less than that of the water. When too many pennies are added, the density becomes too large and the boat will sink.

What did you experience?
What shapes were your boats? Did they float? What was the largest number of pennies were you able to add before the boat sank? How was the shape of your best penny-floating boat different from the other boats?

References
https://www.sciencebuddies.org/science-activities/aluminum-foil-boats-float

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