



Course **Advanced Manufacturing**
Section: **Robotics Engineering**



James Rumsey
Technical Institute

Weld with Chocolate

What You Will Do

See how materials, even chocolate bars, can be made stronger by welding them into a box.

Materials You Will Need

- 4 small chocolate bars like Hersheys Miniatures or Andes Mints
- Paper plate
- Wax paper
- Microwave safe drinking glass or glass jar
- Water
- Objects for weight
- Kitchen or bathroom scale
- Refrigerator or freezer

Fusion Welding

There are many different types of welding. In this activity, you will fuse four pieces of flat stock (chocolate bars) together by melting their edges and joining them together. Once the chocolate is cooled, the bond will be strong.

Flat bars of steel aren't always strong enough on their own. Welders often create box welds to increase their strength.

Compressive Strength

Compressive strength is a measurement of how much weight or downward force a structure can hold without failing.

Step 1: Get Set Up

Gather your materials. Set out the paper plate and unwrap the chocolate. Fill the glass or jar most of the way. Leave a couple of inches at the top to make it easy to move without spilling.

Step 2: Heat the Water

Place the water in the microwave. If you are using a jar, do not put the lid on the jar. Microwaving water in a closed container can be dangerous. Microwave the water for about two minutes. Chocolate melts at a low temperature. The water does not need to be boiling. It only needs to be as hot as you would need for a cup of tea or cocoa.

Step 3:

1. Carefully remove the hot water from the microwave and move it to the paper plate.
2. Using both hands, press one edge each of two chocolate bars against the side of the glass or jar. The sides of the glass are warm from the hot water.
3. Once the heat has melted the chocolate edges, press those two edges together. This creates two sides of a box.
4. Place these fused bars onto the paper plate with one bar laying flat and the other sticking straight up. You might need to use something to prop up the bar that is standing up. The chocolate is still soft and will need to set before it becomes strong.
5. Repeat the process with two more chocolate bars.

Step 4: Cool the Box Sections

Remove the glass or jar from the plate. Place the plate with the two box sections into the fridge or freezer.

Step 5: Create a Box

Repeat steps two and three to weld the box sections together. Place the plate with the completed box into the fridge or freezer.

Step 6: Test the Strength of the Box

1. Put a sheet of wax paper on a scale. Use wax paper to keep everything clean. This way you can eat the chocolate when you're done!
2. Place your box on its side on the paper. Put another sheet of paper on top of the box.
3. How much weight do you think this little chocolate box can hold? Carefully place weights, such as books, on top of the box one at a time.
4. Check the weight each time you add an object.

How did you do?

How close was your guess? If you haven't eaten all of the miniature bars yet, try repeating this experiment by fusing three of them together into an I-beam. How can welding a vertical bar between 2 horizontal bars increase its strength? Will two I-beams next to each other hold more weight than one welded box?