The Society of Rheology
K12 Outreach Activities

Science is FUN!

Capillary Origami

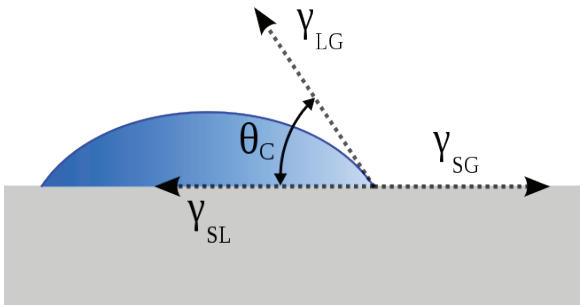
Origami is the art of folding paper. In classical origami paper is folded by hand to transform a two-dimensional (2D) sheet of paper into a three-dimensional (3D) object. Here we will explore a new way to generate 3D object using the interaction force between a liquid and a solid to do the folding for us. The forces needed to fold the paper will be generated by surface tension. Surface tension is a force per unit length caused by an attractive force between molecules that holds them together. It is the property of liquids that pulls them into a spherical shape to minimize the surface area, but it can also exhert a force on a solid that can support the weight of a heavy object floating on it and keep it from sinking or even bend a thin solid sheet into amazing shapes.

What you will need to get started

- Saran wrap cut into squares of different sizes
- Scissors to cut the Saran wrap into squares
- Water
- Transfer pipette and tweezers
- Paper towels for cleanup

More about surface tension

- Liquids and solids interact through surface tension, γ, and contact angle, θ
- If water likes a surface, the contact angle is small, $\theta < 90^o$, and the surface is hydrophilic
- If water dislikes a surface, the contact angle is large, $\theta > 90^o$, and the surface is hydrophobic
- The larger the surface tension the larger the force exherted on the solid
- This force is quite small so to see the effect we need very thin sheets of Saran wrap cut into very small shapes



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Let's experiment!

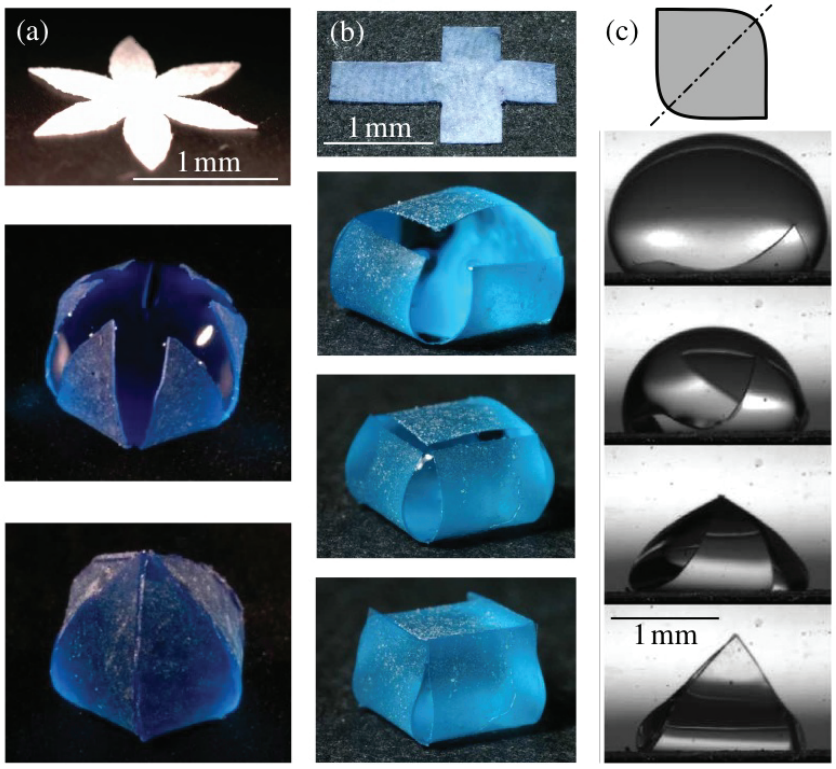
1. Start with the biggest square of Saran wrap. Lay it flat on the table and carefully place one drop of water on the sheet
   - What happens?

2. Repeat with progressively smaller squares of Saran Wrap.
   - What happens as the squares get smaller?

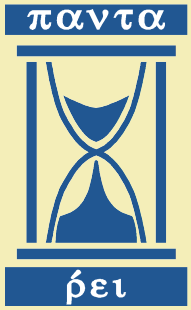
3. Suggest some ways to make more comples and intersting 3D shapes

4. Now place a drop on a square and let the water evaporate over time.
   - What happens to the shape? Is the folding permanent?

6. Repeat the experiments sheets cut into different shapes. Can you build a box? Can you build a sphere?



Images from - Py et al., "Capillary Origami: Spontaneous Wrapping of a Droplet with an Elastic Sheet," Phys. Rev. Lett., 98 (2007) 156103.



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