

Antibubble

1. What's an antibubble?

What's this?



Soap bubble

What's this?



Antibubble

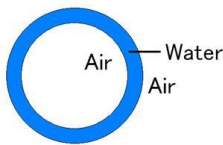
What's the difference between these two objects?

A soap bubble is formed in the air.

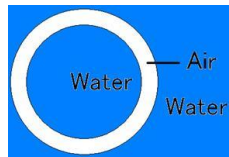
An antibubble is formed in the water.

A soap bubble is air surrounded by the thin film of water.

An antibubble is a droplet of water surrounded by the thin film of air.

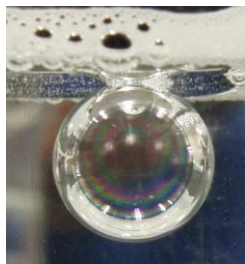


Soap bubble



Antibubble

We can observe interference colors on the surface of both these objects.



Interference colors

2. How can we make an antibubble?

Preparations

tap water, straw, detergent, tank or glass



Detergent



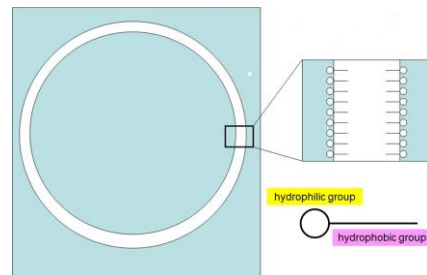
Experiments

1. Pour the water into the tank.
2. Add a little detergent.
3. Sink the end of a straw into the solution.
4. Close another end of a straw with fingertip.
5. Lift the straw from the surface of the solution keeping the fingertip on another end of a straw.
6. Hold the end of the straw near the surface of the solution.
7. Let go of the fingertip from another end of a straw.

3. Structure

The air-liquid interface is composed of oriented surfactant molecules.

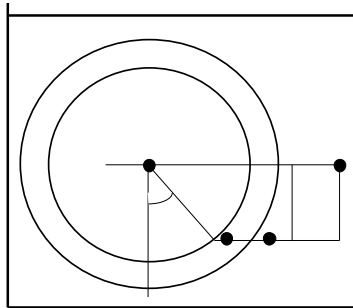
This particular structure ensures air-shell stability.



Oriented Surfactants

4. Buoyancy

Buoyancy brings antibubbles towards the surface where they stick before naturally pop up.



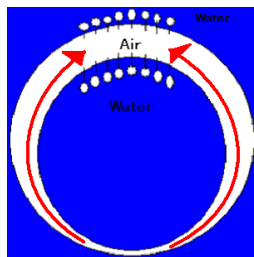
Buoyancy

$$= \int (p_0 + \rho g r \cos \theta + \frac{2\gamma}{r}) \cos \theta dS$$

$$= \frac{4}{3} \pi r^3 \rho g$$

5. Collapse

The gravitational thinning of the air film occurs at the bottom. So air-shell breaks at the bottom and the film quickly collapses in the direction to the top.



References

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