

Materials Science and Engineering at Home – Pykrete

Things you'll need:



- 2 takeaway plastic containers (lids are not necessary; Tupperware containers work as well)
- Toilet paper (any brand)
- Measuring jug
- Permanent marker
- Tap water

Method:

Step 1: Label one of the plastic containers with 'Ice' and the other with 'Pykrete'



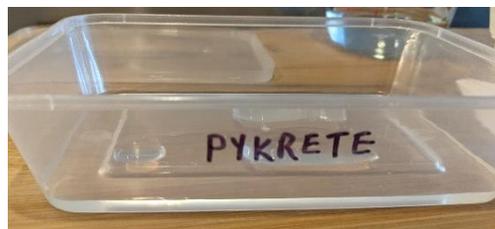
Step 2: Measure out 100 ml of tap water using the measuring jug (for ice).

Step 3: Pour it in the container labelled 'Ice'. Seal the container with the lid (if there is one).



Step 4: Measure out 100 ml of tap water using the measuring jug, again (for pykrete).

Step 5: Pour a little bit of the water, just to cover the surface of the container (around 30-40 ml).



Step 6: Layer individual sheets of toilet paper in the container, pressing down gently so that the toilet paper absorbs the water.



Step 7: Continue adding layers of toilet paper until most of the water is absorbed.

Step 8: Pour more water in and continue adding more toilet paper (repeat steps 5-7 until all the water is poured into the container and most of the water is absorbed by the toilet paper).

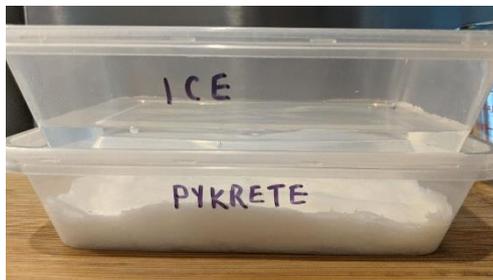
When you press gently on the layers of toilet paper, only a small amount of water should pool and reabsorb back in once you remove your finger.



(Hint: I used 40 sheets of toilet paper for 100 ml of water)

Step 9: Cover the pykrete container with the lid (if there is one).

Step 10: Place both containers in the freezer for at least 6 hours until the water is completely frozen. (It's best not to tilt or put the containers in the freezer at an angle to prevent water from leaking out of the containers).



Video instruction can be found here if needed: <https://youtu.be/1Y3MgeWotnU>

Material Property Testing

Drop your pykrete and ice samples from shoulder height onto the floor.

To prepare your testing area, find a space that is at least 1m x 1m with a hard floor (tile or concrete), wear eye protection - safety goggles or glasses (if possible), wear enclosed shoes to protect your feet. Dropping the pykrete and ice on cushioned flooring may affect the results you get. You can put a plastic sheet or have a towel handy on the side to clean up the mess you might make.

Make sure you keep the height you drop both pykrete and ice consistent. You can set up a camera to film you dropping pykrete and ice, and/or take lots of the result afterwards. A good scientist or experimental engineer records down all the details and observations of the experiment.

Discussion and Questions to think about

- What happened to pykrete upon impact with the floor?
- What happened to ice upon impact with the floor?
- How does adding toilet paper help/not help?
- What other advantages/disadvantages are there to pykrete?
- What are the potential applications of pykrete?
- How would the material properties compare in pykrete made of a different brand of toilet paper, leaves, fabric, straws, cardboard, and etc?

Video of pykrete testing can be found here: <https://youtu.be/w6V8rTeSSMA>