Composites

Composites are interesting materials for children to explore. They are made of two or more materials which give the resulting mixture different properties to those at the start.

An early example was mud bricks. It is possible to dry mud in a brick shape to give a building material. It is strong if you squash it, but breaks easily if you try to bend it. Straw is strong if it is stretched but crumples easily. Mixing mud and straw gives a material that is resistant to both squeezing and tearing and makes excellent building bricks. There are also natural composites including wood and bone, although this is harder for children to understand as without a microscope it is not possible to see the two separate materials.

In recent years there has been a huge increase in both the number of composites available and the number of applications using them. Many (but not all) of the modern composites are made from a plastic with something added to it. This might be glass fibres, carbon fibre, ceramic, metal or something else.

Introducing composites

There is a brief power point presentation which has some images of different sporting composites.

If you can get hold of some older and more modern sporting equipment, children could explore the change in properties of the materials used for particular items. Good examples are tennis rackets and hockey sticks. The older ones are made of wood and are noticeably heavier than the modern examples made of carbon fibre. Will tennis rackets this has led to them being made much larger.

For older children, this clip from BBC Learning Zone shows[1] Chris Hoy explaining what a track cycling bike is made from (mainly carbon fibre which is a composite) and why. The first 2 minutes are about the bike.

Making a composite

Children can make a composite from fabric and a flour and water paste. They can compare the properties of the composite they have made to the properties of the individual materials.

The activity could be extended into an investigation if wished. Children could make mini samples of composite using just two pieces of fabric with varying mixes used to hold them together. Different types of flour (white, wholemeal, corn flour, rice flour etc) could be tried along with watered down PVA glue.

The moulded composite could be tested for strength. This could be done in a number of ways including stacking weights onto it until it crushes. (Be aware of health and safety implications of this.)

The composite pots could be tidied up and painted.

[1] BBC Learning Zone, Chris Hoy's track cycling basics, http://www.bbc.co.uk/learningzone/clips/chris-hoys-track-cycling-basics/5652.html

To make the basic pots you will need:

- Strips of fabric, about 5 cm x 3 cm – students could cut their own strips (in which case they will need sharp scissors). The amount that they will need depends on the size of the moulds they are using. Alternatively, they can use pieces of fabric large enough to drape over their mould and simply use 3 of these soaked in flour paste.
- Flour – about 2 or 3 tablespoons per mould, but again this will vary depending on the size of their mould.
- Water
- Oil or Vaseline
- Mixing pot per child or group
- Spoon
- Plastic pot as mould for composite per child or pair
- 2 other plastic tubs as moulds per child or pair
- Cling film
- Newspaper or old magazine per child or pair

What to do

- Put some flour into the mixing pot and add a little water. Mix the flour and water, adding more water slowly until the mixture looks like thick cream.
- Grease the outside of the tub that will be used as the composite mould.
- Dip a strip of fabric into the flour water mixture, get it well coated and then drape it over the composite mould. Continue adding strips of fabric until the mould is covered.
- Add a second layer of flour-soaked fabric. Try to get the fabric strips lying in the opposite direction.
- Add a third layer then place a piece of cling film on top of a newspaper or magazine and transfer the composite to the cling film.
- Cover another tub with flour paste (don't grease it). Add this tub to the cling film – not touching the composite covered tub.
- Leave the tubs to dry in a warm place for at least two days. If the composites are turned after a day or two it will help them to dry faster.

When the composite has dried

Carefully remove the plastic tub from the dried composite. This can be tricky and the tub may need to be pushed inwards to release it from the composite.

Get the children to compare the properties of the fabric, the dried flour paste (which is very brittle) and the composite. The composite is much harder, stronger and rigid than the starting materials. Children could put their results into a table. Depending on age and ability, you could give them a list of words that they might want to use to describe the materials. Words may include: strong, weak, tough, brittle, stiff, flexible, hard, soft, rigid.

For further ideas on exploring the properties and uses of materials, see the Royal Society of Chemistry's book for Primary Teachers*, That's Chemistry*.[2]

[2] *That's Chemistry* by The Royal Society of Chemistry, http://stem.org.uk/rx6zy