

Discover Smart Materials:

Photochromic materials

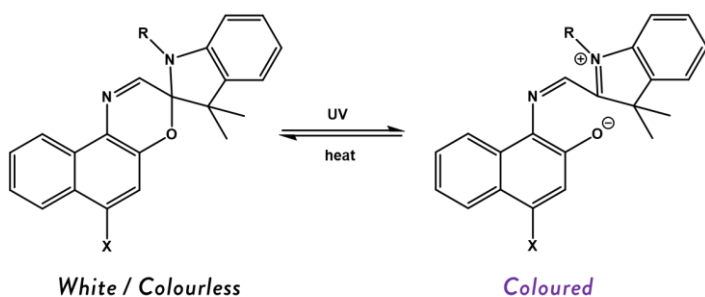
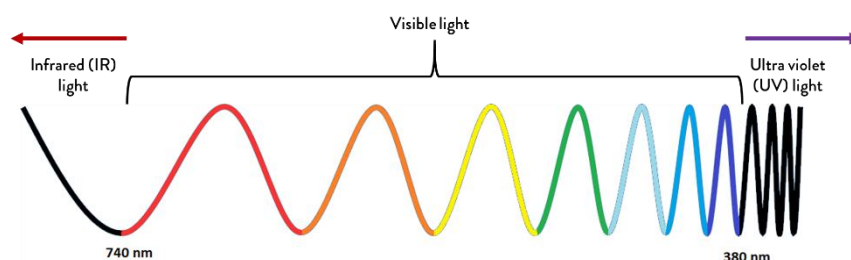
DISCOVER MATERIALS



Photochromic materials change colour in response to light and then return to its usual colour once the light is removed. UV colour changing materials, which

are often sold as beads to thread onto string to make homemade jewellery, are made up of a plastic that contains a compound that changes colour when exposed to ultraviolet light.

This colour change occurs because the UV light gives the chemical dye enough energy for it to change its structure from a colourless one to a structure that is coloured.



Once the UV light is removed the temperature surrounding the bead gives it enough energy for the dye compound to change its structure back to its colourless form.

These beads can be used to detect the presence of UV light and, as a result, can be used to test how good a material is at blocking UV radiation (see the 'Mission Starlight' experiment link below).

Curriculum Links

- Chemistry (National Curriculum, Key Stage 4: Energy Changes in Chemistry: 'Bond breaking, bond making, activation energy and reaction profiles (qualitative)')
- 'Core technical principles - Smart Materials' (AQA GCSE Design and Technology, Section 3.1)

Learn more

- Royal Society of Chemistry (RSC) 'Mission Starlight': <https://edu.rsc.org/resources/mission-starlight/2073.article>
- How do photochromic materials work? <https://tinyurl.com/5cau67mz>

Try this in the classroom

You will need

- Ultraviolet (UV) torch OR
- Invisible ink pen



From ~£6 each:

<https://tinyurl.com/bdw8wnst>

Look for the '395nm' (which refers to the wavelength of light the torch produces) torches as these are likely to be safer than ones that emit smaller wavelengths.



They often have small, low powered UV lights attached

Pack of 7 invisible ink pens from ~£6: <https://tinyurl.com/28sc9tz5>

- UV colour changing beads OR
- UV colour changing 3D printing filament

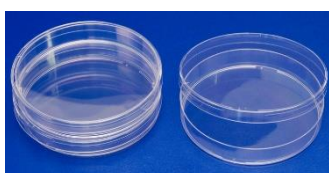


Bag of 100 beads from ~£4
<https://tinyurl.com/2n7kp6yp>



1kg spool of 1.75mm diameter filament from ~£20: <https://tinyurl.com/m5fzwf64>

- Shallow dish
e.g. Plastic Petri dishes
Plastic petri dishes (pack of 20) from ~£3:
<https://tinyurl.com/mrxv47fu>



Optional

- Different sheet materials (e.g. Aluminium foil, scraps of fabric, sweet wrappers, squares cut from plastic milk bottles)
- UV Index chart (see RSC's 'Mission Starlight' page – follow the link above)

What to do

- Take the UV colour changing beads (or an object 3D printed using the UV colour changing PLA filament)
- Shine the UV light source (torch or the light from an invisible ink pen) on them
- Observe the colour change of the beads.

Risks!! Do not shine the UV light sources into people's eyes – it can cause eye damage

Clear up any spilt beads immediately as they will be a slip hazard

Ideas for in class activities

- Investigate the factors that affect the intensity of the colour of the beads – try different exposure times or distances between the UV light source and the beads (remembering to allow the beads to return to their original colour each time).

A worksheet will be available on our website soon.

- Leave batches of beads in different places in the classroom to see if all levels of exposure UV are the same (e.g. near windows, under the desk). This works very well in Summer when the UV levels outside are highest.
- Try out the RSC's 'Mission Starlight' experiment (see link above) which has been adapted for use in our UKSA funded 'Let's Move to the Moon' project (see video here: <https://youtu.be/jDIZnefwO7E>).

The future is what you make it, but it is also what you make it out of

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