What is fluorescence?

Fluorescence is a phenomenon in which certain materials are able to give off visible light after absorbing nearly invisible light of a certain wavelength, such as ultraviolet light.

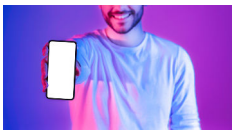
Fluorescent glass is unique in that it can appear ordinary under visible light and then can emit vivid colors when excited by certain wavelengths. The fluorescence in glass occurs with the presence of rare earth elements (lanthanides), which absorb invisible UV photons and then emit visible photons in the range of 400-700nm so that we see color.

When the rare earth ions are excited, an electron absorbs the short wavelength energy and is raised to an excited state. In a hundred thousandth of a second, the electron returns to the ground state by the emission of a photon of a longer wavelength.

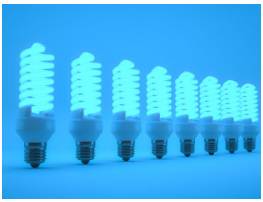
In other words, fluorescent behavior is the absorption of short wavelength light and the subsequent emission of a longer wavelength light.

Some of the rare earth color emissions:

- **Eu** Europium: red/dark pink
- **Sm** Samarium: orange
- **Tb** Terbium: green
- **Ce** Cerium: cyan
- **Dy** Dysprosium: yellow
- **Tm** Thulium: blue



Europium, for example, is used to produce blue, red, and white radiance in computer monitors and television screens. It is also used in energy efficient light bulbs.



Experiment

With this card you will find two pieces of glass that are transparent and nearly colorless. You will also find a small UV light to use to view the glass pieces. Make sure to follow safety precautions when using the UV light.

After looking at the glass in normal light, darken the room and examine each piece of glass under the black light. What do you see now? You will notice a visible show of various colors from the “clear” glass due to the rare earth elements contained in the glass!

Fluorescence in glass has many applications including medical imaging and biomedical research, such as the use of fluorescence spectroscopy as a diagnostic and research tool in many fields of medical sciences.

Fluorescence is found in many materials that you may have at home, such as laundry detergents, petroleum jelly, turmeric, olive oil, tonic water, and ketchup. Teeth have natural fluorescence, but human-made dental crowns usually don’t.

Rare earth elements have been used for a long time in established industries such as catalysts, glass making, lighting, and metallurgy, which combined account for 59% of the total worldwide consumption. They are also being used in newer, high-growth areas such as battery alloys, ceramics, and permanent magnets, which account for the other 41%.

To access the video demonstration and additional teaching materials, scan the QR code below!

The Ceramic and Glass Industry Foundation

https://foundation.ceramics.org/