Luminescence

Luminescence is defined as the emission of light that is not a direct result of applying an electrical current to a filament. There are many forms of luminescence such as fluorescence, phosphorescence, bioluminescence, triboluminescence, and chemiluminescence.

Fluorescence is the absorption of light of one energy and the immediate release of light at the same or more commonly at a slightly different energy. This is seen in fluorescent paint. Phosphorescence is the absorption of light at one energy and the delayed release of light. This is seen in glow in the dark paint and dyes.

Bioluminescence is the release of light by plants or animals. Fireflies, algae, and deep sea organisms produce light. Mosquito Bay in Vieques, Puerto Rico has such a high concentration of bioluminescent algae, that is commonly called “bioluminescent bay” and tourist tours are regularly scheduled.

Chemiluminescence

The most common way in which chemical reactions dispose of excess energy is by releasing heat. This is exothermicity. Some chemical reactions dispose of excess energy by releasing it in the form of light. This is called chemiluminescence. This is normally done by electrons in an excited state cascading to lower energy molecular orbitals with the simultaneous emission of light.

In today’s demonstration luminol will be reacted with sodium hydroxide, hydrogen peroxide and Fe(III) to produce a triplet excited state dianion, which will proceed first to the singlet state and then go onto the ground state. The energy released will be light with a lambda max of approximate 450 nm. What color do you expect? (What is the color of 450 nm light?)
**Mechanism:**
A reasonable progression of the reaction mechanism is listed. vii

In today’s demonstration a sodium hydroxide solution will be mixed with the luminol, hydrogen peroxide, Fe(III) solution. Luminol is also used by forensic detectives. It is sprayed at a darkened crime scene, if iron is present from the hemoglobin of blood, it will glow.

**Triboluminescence**
Triboluminescence is when light is produced by materials being crushed, rubbed, or mechanically stressed. You can examine this phenomena on your own with a dark room and Wint-O-Green Lifesavers. x Let your eyes adjust to the dark. Chomp down, with your mouth open (like a monster), and see the sparks (also like a monster). We would do this in lab, but eating is not allowed in any lab, especially organic chemistry lab.
Today's lab is a demonstration lab. No pre-lab notebook is required. It will not be included on the final exam.

Revised November 18, 2013, S.L. Weaver

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