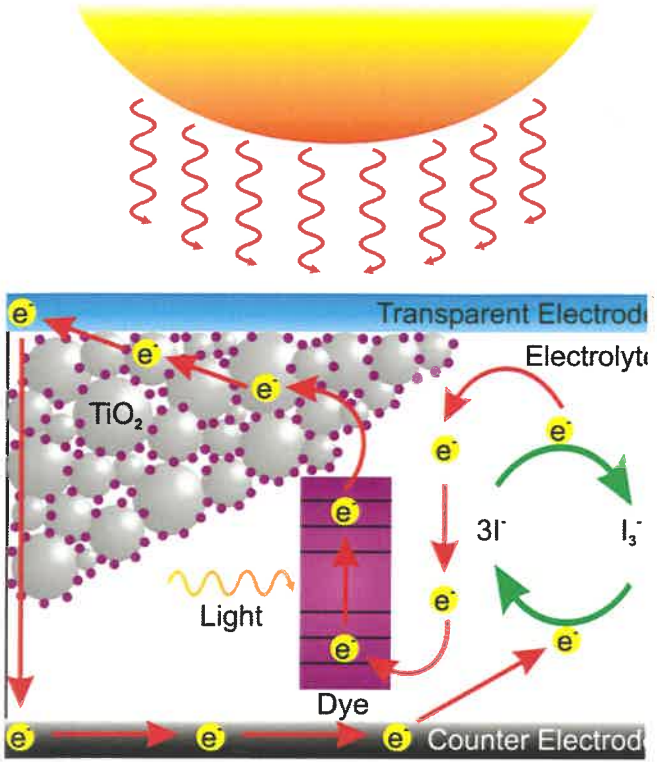


A scheme showing how DSSCs work. Light absorbed by the dye forms an excited state that transfers an electron through to the first electrode. After a current is produced, the counter electrode transfers this electron to a sacrificial donor, which reforms the dye's ground state. [1]

A dye-sensitised solar cell, or DSSC for short, is a type of solar cell based on thin films. A semiconductor is formed between a photo-sensitised anode and an electrolyte to form a photoelectrochemical system.

Originally invented by Brian O'Regan and Michael Gratzel at UC Berkeley, the first high efficiency DSSC was published in 1991.

DSSCs are particularly attractive, because they are simple to make, transparent and semi-flexible (unlike glass based systems), and the majority of the materials used to make them are low cost. Kezia even runs an outreach experiment in the department, where students make their own DSSCs using fresh berry juices.

However, it has proven difficult to remove some of the required expensive materials, such as ruthenium or platinum complexes. It is also difficult to use them in multiple weather situations, due to the liquid electrolyte.

Though it does not perform as well as the best thin film cells, DSSCs are so cheap that the ratio of price to performance is good enough to allow them to compete with fossil fuels! In fact, if the last few issues involving their stability are solved, you could see them used by 2020.

1. bit.ly/2JOY0Xt

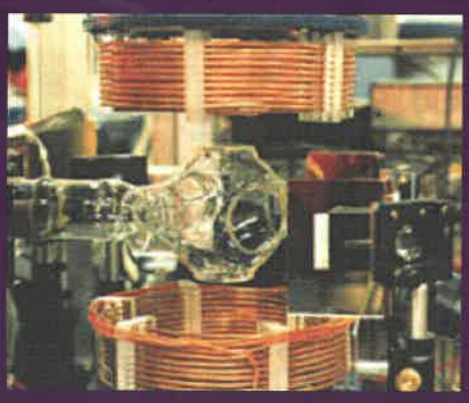
Elemental Factfile: Francium

87
Fr
223

Francium, element 87, is one of the most radioactive and unstable elements in the periodic table. Naturally, it only occurs in tiny quantities in uranium and thorium ores, so there is only an estimated 30g of Francium in existence on Earth at any one time. There are 33 known isotopes of Francium; most having half-lives of less than a minute, with the longest of Fr-223 only 22 minutes! This means Francium is so radioactive, that if you were ever able to isolate a substantial chunk, it would probably swiftly evaporate due to the heat it would produce.

Francium is assumed to have similar chemical and physical attributes to caesium, the element above it on the periodic table. Throw any alkali metal into water and you're guaranteed a dramatic display, if you were able to get enough francium to throw it into water, the explosion would be massive!

Due to its exceptionally short half-life, there are no commercial or medical uses of Francium. As such it is created purely for research purposes, by using a particle accelerator to bombard thorium with protons, or a nuclear reactor to bombard radium with neutrons. In fact, the largest amount produced at one time in a laboratory was a cluster of around 300,000 atoms.



A magneto-optical trap, used to hold neutral francium atoms for short periods of time.

Francium was the last naturally occurring element discovered, by Marguerite Perey in 1939, who noticed that the β emission of a sample of actinium was more intense that it should have been. She hypothesised that it was due to element 87 present in the sample, which proved to be correct.

Since element 87 is the most electropositive of all the elements, Perey proposed the name catium. Some scientists hated this name, saying it sounded related to cats, rather than cations. The name francium was proposed after Perey's homeland. Perey was honoured by becoming the first female member of the 200-year-old Institut de France, Academie des Sciences – a gender barrier that even her mentor, Marie Curie, was unable to break through.