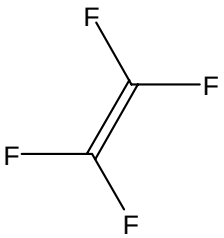
The discovery of Teflon™

Topics

Polymers, people

Teflon (chemical name poly(tetrafluoroethene), ptfe) was discovered by accident although the story of its discovery does recall the phrase ‘chance favours the prepared mind’. In 1938, 26-year old Roy Plunkett was working for DuPont on gases for use in cooling fridges, one of which was tetrafluoroethene. On 6th April he opened the valve of a cylinder containing about 1 kg of the gas but nothing came out. He did what many of us would do and poked the valve with a wire but to no avail. He then weighed the cylinder and the weight indicated that it was still full. When he shook the cylinder it rattled. Eventually he sawed open the cylinder to find that it contained a solid. Somehow, the gas molecules, which each have a carbon-carbon double bond, had polymerised. Because this is an addition polymer, no other reactant is needed. No-one seems to have a clear explanation about what caused the spontaneous polymerisation.



Tetrafluoroethene

Teflon is chemically inert (because it is saturated and has only strong C-C and C-F bonds) and very slippery. Its best known use is as the coating of non-stick pans. During the Manhattan Project that produced the first atomic bomb, Teflon was used for valves and gaskets that would resist chemical attack by highly reactive uranium hexafluoride. This compound was used to separate the isotopes ^{235}U (which will fission) and ^{238}U (which will not) by gaseous diffusion. Uranium hexafluoride is unusual for a metal salt as it is volatile and becomes a gas at 56 ^{o}C. The lighter $^{235}UF_6$ gas diffuses through a porous barrier faster than $^{238}UF_6$ and this was used as the basis of the separation method. It is also said that the American space programme would have foundered without Teflon because the material was used to make so many things from space suits to the bags used to hold samples of moon rock.