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Burning Fluoropolymers

There is potential for any material to release harmful substances when it is burnt, particularly if the combustion is incomplete or poorly controlled. Examples are the carcinogenic benzopyrenes created by burning food and the toxic chemicals formaldehyde and acrolein from a candle flame.

Fluoropolymers are highly resistant to heat; hence they have been used for more than 40 years in cookware and electrical insulation. However, they can be made to decompose in air if heated to a high enough temperature. The combustion products of fluoropolymers were carefully characterised in the 1970s [1]: the principal material formed is carbonyl fluoride (COF_2), with minor amounts of a number of more complex molecules, including trifluoroacetic acid (TFA). Carbonyl fluoride is toxic and consequently the operating conditions for systems containing fluoropolymers are carefully specified to ensure that no combustion (or similar decomposition) takes place. Carbonyl fluoride does not persist in the environment.

Researchers in Canada described tests they had performed on burning PTFE (polytetrafluoroethylene) on its own and attached to items of cookware [2]. Unfortunately, their analytical method was flawed; the carbonyl fluoride was not captured and analysed and so undue emphasis was placed on the minor components, including TFA. TFA is a ubiquitous natural component of seawater.

There is no evidence that PTFE coated cookware releases harmful chemicals during use (or abuse); furthermore, it has been shown that fluoropolymer materials (such as coated textiles) do not yield harmful chemicals when incinerated.

References

1. Arito H. and R. Soda, Pyrolysis products of polytetrafluoroethylene and polyfluoroethylenepropylene with reference to inhalation toxicity, *Ann. occup. Hyg.*, 20, 247-255, 1977
2. Ellis A.A., S.A. Mabury, J.W. Martin and D.C.G. Muir, Thermolysis of fluoropolymers as a potential source of halogenated organic acids in the environment, *Nature*, 412, 321-324, 2001.