

**NOTE**

## **Some Basic Aspects on Terminology Concerning Flammability**

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This study characterizes the terms and definitions concerning the flammability of materials.

**Key Words:** Flammability, Flaming, Flame-resistant.

Terms used to describe the flaming properties of materials are sometimes misleading!

While there are many definitions of the terms used in flammability studies, they do not always appear satisfactory. For instance, the term 'Inflammable' as a synonym for flammable is deprecated in BS 4422 part 1 (1969)<sup>1</sup>.

This article summarizes some basic announcements concerning flammability.

- **After glow:** The time, the specimen continues to glow after it has ceased to flame<sup>2</sup>.
- **Autoignition:** As the result of a sharp increase in the rate of exothermic reactions leading to spontaneous combustion in the absence of heat source, self-ignition or autoignition is resulted; it is also known as spontaneous ignition<sup>3</sup>.
- **Char length:** The distance from the edge of the specimen exposed to the flame to the end of the tear made through the centre of the charred area<sup>4</sup>.
- **Combustion:** The reaction of oxygen with a material is described as combustion.

A substance is said to be combustible if it ignites readily upon contact with a flame and continues to burn under normal conditions<sup>2</sup>.

Webster's Dictionary (1995 Edn.) defines combustion as 'any chemical process accompanied by the emission of heat and light, typically by combination with oxygen'<sup>5</sup>.

- **Combustibility:** The ability of the materials to take part in combustion process<sup>1</sup>.
- **Duration of flaming:** Time for which the supported specimen continues to flame after extinction of the butane flame. This measurement is only made when the flaming ceases due to the behaviour of the fabric and not because the flame has reached the edge of the specimen<sup>6</sup>.
- **Fire failure:** The inability of a structure to continue to carry out its

functions or stability, integrity or insulation in the course of a fire failure test<sup>1</sup>.

- **Fire triangle:** The combination of three factors: fuel, oxygen and heat, to sustain the burning process. If one factor is missing burning will not occur<sup>5</sup>.
- **Flame penetration:** The ability of an object, or some specified part of an object, to be penetrated by an applied flame<sup>1</sup>.
- **Flame proof:** A flame-proof fabric is one which does not propagate the flame, *i.e.*, any flame goes out quickly when the igniting flame is withdrawn<sup>7</sup>. Flame-proof is not recommended to be used exceptional in electrical apparatus<sup>1</sup>.
- **Flame-resistant:** Textiles are referred to as flame-resistant that can resist ignition for a limited time and if they do ignite, continue to burn or smoulder for only a short time, after the heat source has been removed<sup>8</sup>.
- **Flame retardant:** Textiles are referred to as flame-retardant which burn with difficulty and which cease to burn on the removal of the source of flame<sup>2,9</sup>.
- **Flame retardant chemicals:** Chemicals denote a compound or mixture of compounds that when added or incorporated chemically into a polymer serve to show up to hinder the ignition or growth of fire<sup>8</sup>.
- **Flame spread:** The propagation of a flame over the surface of a combustible solid<sup>10</sup>.
- **Flammability:** The ability of the material to burn with flame<sup>1</sup>.
- **Flammable fabric:** A flammable fabric is one which propagates flame, *i.e.*, it continues to burn after the igniting flame has been removed<sup>7</sup>.
- **Flash and flash ignition temperature:** Flash is a rapid burning of a combustible mixture without compression of gases<sup>3</sup>.
- The lowest initial temperature of air passing around the specimen at which sufficient combustible gas is evolved to be ignited by a small external pilot flame<sup>10</sup>.
- **Flash point:** The lowest temperature at which the vapour above a combustible liquid will ignite in air when exposed to a flame<sup>5</sup>.
- **Glow:** The flame-less reaction of the carbon residue with oxygen after the ignited material has ceased to flame<sup>2</sup>. The above combustion is in the solid phase with emission of heat from the surface<sup>6</sup>.
- **Heat release:** The ability of the material to release calorific energy during combustion<sup>1</sup>.
- **Ignitability:** The ability of the material to be ignited<sup>1</sup>.
- **Ignition:** Flaming of the specimen for a period of 1 s or more after extinguishing of the (butane) flame<sup>6</sup>.
- **Ignition temperature:** The lowest temperature at which combustion of the material will occur spontaneously under specified conditions. The above definition is sometimes called 'Autoignition temperature'<sup>5</sup>.

- **Inflammable textile:** A textile is inflammable if it ignites after exposure to a heat source to form flame<sup>11</sup>.
- **Life cycle of fire:** The stages at which the burning process occurs. It can be divided into four stages; ignition, propagation, steady combustion and termination<sup>5</sup>.
- **Non-inflammable textile:** A textile is non-inflammable if despite exposure to a heat source up to about 600°C, it does not ignite and is expected to retain its shape<sup>9</sup>.
- **Pyrolysis:** Pyrolysis is the chemical decomposition of a material by heat and is a synonym of thermal degradation<sup>10</sup>.
- **Smouldering:** The burning and smoking or wasting away by a slow and suppressed combustion without flame (the rate of oxidation is so slow that no visible light is emitted)<sup>10</sup>.
- **Smoke release:** The ability of the material to release smoke during combustion<sup>1</sup>.
- **Theoretical combustion temperature:** The temperature to which all the combustion products are heated if it is assumed that all heat of combustion is used to heat these products.

$$t = \frac{Q + mc\theta}{mc}$$

where t is theoretical temperature of combustion.

m is the amount of combustion products formed during burning of 1 kg of fuel,

c is the heat capacity of combustion products kJ/kg K°,

Q is the air temperature (K),

θ is the heat of combustion, kJ/kg.

The actual combustion temperature is 30–50% less than the theoretical temperature because considerable amount of heat is dissipated into the environment<sup>3</sup>.

## REFERENCES

1. *Fire Prevention*, 123, 15 (1978).
2. S.M. Mostashari, M. Phil. Thesis, Leeds University (1978).
3. M.K. Poltev, *Occupational Health and Safety in Manufacturing Industries*, Mir Publishers, Moscow, p. 215 (1985).
4. AATCC Technical Manual, Vol. 34 (1966).
5. M. Kesner and W. de Vos, *J. Chem. Educ.*, 78, 41 (2001).
6. British Standard, BS 5438 (1976).
7. J.E. Booth, *Principles of Textile Testing*, Heywood Books, London (1970).
8. *Encyclopedia of Polymer Science and Technology*, Vol. 10, p. 348 (1984).
9. *Textile Flammability and Consumer Safety*, Gattlieh Duttweiler Institute Publication, Zurich, p. 45 (1969).
10. N.H. Knoepfler, *Fire. J.*, 70, 53 (1976).
11. C.Z. Carroll Porczynski, Ph.D. Thesis, Leeds University (1972).

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