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Ignition Temperature, Flammable Limits, Flammable Range, and Flash Point

Ignition Temperature of a substance, whether solid, liquid, or gaseous, is the minimum temperature to which the substance must be heated in order to initiate or cause self-sustained combustion independently of the heating or heated element.

Ignition temperatures observed under one set of conditions may be changed substantially by a change of conditions. For this reason, ignition temperatures should be looked upon only as approximations. Some of the variables known to affect ignition temperatures of flammable liquids and gases are percentage composition of the vapor or gas-air mixture, shape and size of the space where the ignition occurs, rate and duration of heating, kind and temperature of the ignition source, catalytic or other effect of materials that may be present, and oxygen concentration. As there are many differences in ignition temperature test methods, such as in size and shape of containers, method of heating and ignition source, it is not surprising that different ignition temperatures are reported for the same substance by different laboratories.

As illustration of the effects of test methods, the ignition temperatures of hexane determined by three different methods were 437°F., 637°F., and 950°F., respectively. The effect of percentage composition is shown by the following ignition temperatures for pentane: 1,018.4°F. for 1.5 per cent pentane in air, 935.6°F. for 3.75 per cent pentane, and 888.8°F. for 7.65 per cent pentane. The following ignition temperatures for carbon disulfide demonstrate the effect of size of space containing the ignitible mixture: in a 200 ml (milliliter) flask the ignition temperature was 248°F., in a 1,000 ml flask 230°F., and in a 10,000 ml flask 205°F. That materials in which the flammable mixture is in contact may affect the ignition temperature is illustrated by ignition temperature determinations for benzene conducted in various containers: 1,060°F. in a quartz container, 1,252°F. in iron, and 1,330°F. in zinc. For further discussions of ignition temperatures of flammable liquids and gases, see Section 6, Chapters II and III.

The ignition temperature of a combustible solid is influenced by rate of air flow, rate of heating, and size of the solid. Small sample tests have shown that as the rate of air flow or the rate of heating is increased, the ignition temperature of a solid drops to a minimum and then increases. The same appears to be the case as the size of the sample increases.

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