

Determining ignition energies of gases and vapors

Flammable liquids are used in many industrial applications. When these substances are used at temperatures above the flash point, an explosive atmosphere must be expected. Whether an explosion actually occurs in the presence of an explosive atmosphere depends on whether an effective ignition source is present in the environment.

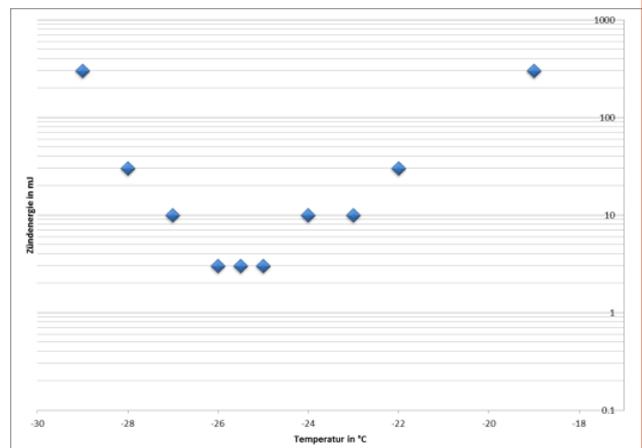


The characteristic value for assessing the ignition capability of an explosive atmosphere is the ignition energy. Ignition energy is the lowest amount of energy required to ignite an explosive atmosphere with a defined concentration.

The ignition energy, depending on the concentration in the gas phase, displays a parabolic correlation with the minimum ignition energy (MIE) as the minimum of the function. The minimum is often observed in the stoichiometric mixture.

There is currently no European standard for determining the ignition energies of gases and vapors. For this reason, consilab has developed an instrument for determining this parameter on the basis of the MIKE3 apparatus, which was used to determine the minimum ignition energy of dusts (see illustration on the left). With this apparatus, the ignition energy can be determined within the energy range of 1 mJ to 1000 mJ. The result provides information on the ignition hazard of various electrostatic ignition sources at different temperatures and fuel concentrations. Furthermore, the ignition energy can be measured not only in air atmospheres, but also, for example, in partially inert atmospheres.

When determining the ignition energies of vapors, the test substance is first placed in the apparatus. With the aid of a thermostat, a double jacket is used to regulate the temperature to control the concentration of the test substance in the gas phase through the vapor-liquid equilibrium. After adjusting the equilibrium between the gas and liquid phase, an ignition spark with a defined energy is ignited. Ignition occurs when a flame discharge from the ignition source is detected visually. The measurement indicates the concentration-dependence of the ignition energy. If the sample is a gas, there is no need to adjust the temperature-dependent equilibrium and the apparatus is rinsed with various concentrations of the test substance.



Ignition energy dependent on temperature

There are minimum ignition energy values for many gases and vapors in the literature. Since these are generally very low, with energies of less than 1 mJ, it is assumed that most ignition sources can ignite gas/air and vapor/air mixtures. Most of the measured ignition energies of the concentrations deviating from the stoichiometric mixture are not available but can be measured with the more advanced apparatus developed by consilab. Because the ignition energy can be greater than 1 mJ here, unlike the stoichiometric mixture, a less conservative ignition source analysis can be carried out at higher or lower concentrations and an explosion protection concept can be developed that is adapted to the process.

Please do not hesitate to contact us if you have any questions about determining ignition energy, as well as about the corresponding applications in your plant or process. Our experts will be happy to advise you. Please also read our previous consiLetter, which is available for download on our website.