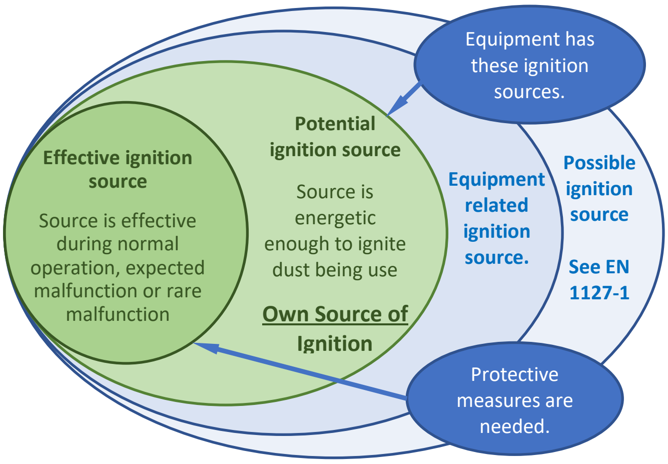
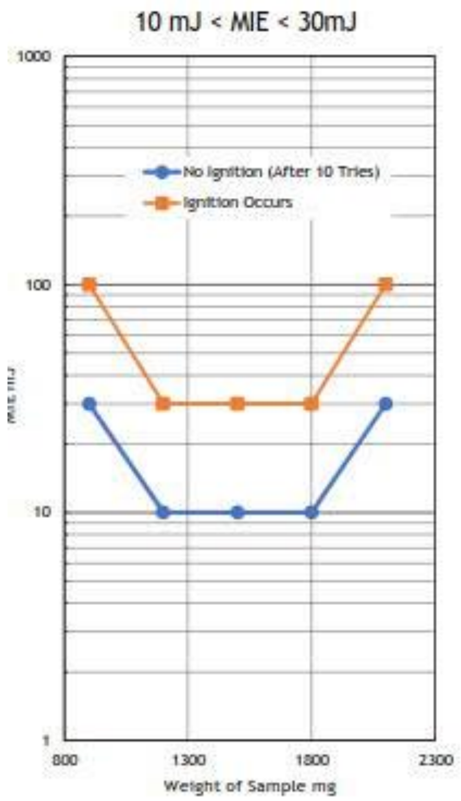
Dust Explosions Sources of Ignition

Part 2 – Impact of MIE on Sources of Ignition.



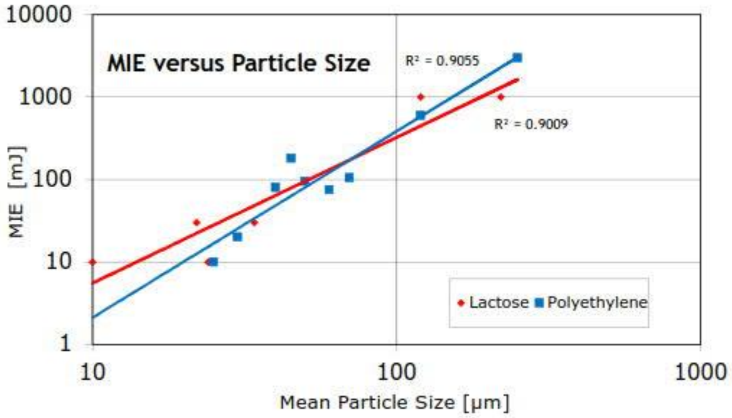
The minimum ignition energy (MIE) of a dust cloud has a significant impact on whether a source of ignition will be an effective source of ignition. EN ISO 80079-36 includes the hierarchy of sources of ignition illustrated in the diagram on the left. Although this relates to sources of ignition caused by equipment, it is equally relevant to sources of ignition created by a process.



The methods of measuring MIE are detailed in EN ISO/IEC 80079-20-2 and ASTM E 2019-03. The MIE can be measured with or without an inductance in the circuit (see the standards for details). Measurement made without an inductance are more relevant to static electricity discharges. This is because (as stated in ASTM E2019-3) almost all electrostatic discharges in plant installations are capacitive with negligible inductance.

On the other hand, it has been found that for equal stored energies many dusts can be ignited more easily when a resistor or an inductance is placed in the discharge circuit to create longer duration sparks. For this reason, most MIE data available is for tests carried out with an inductance.

The testing protocols usually involve measurement at a number of different energy levels, for example 1, 3, 10, 30, 100, 300 and 1000 mJ and with different size samples in the test chamber. This leads to results as show in the graph to the left where a set of data points showing the lowest test energy level where ignition does occur (30 mJ in this case) are produced and another set showing the highest test energy level where ignition does not occur (10 mJ in this case) and the results are reported as 10 mJ < MIE. <30mJ.

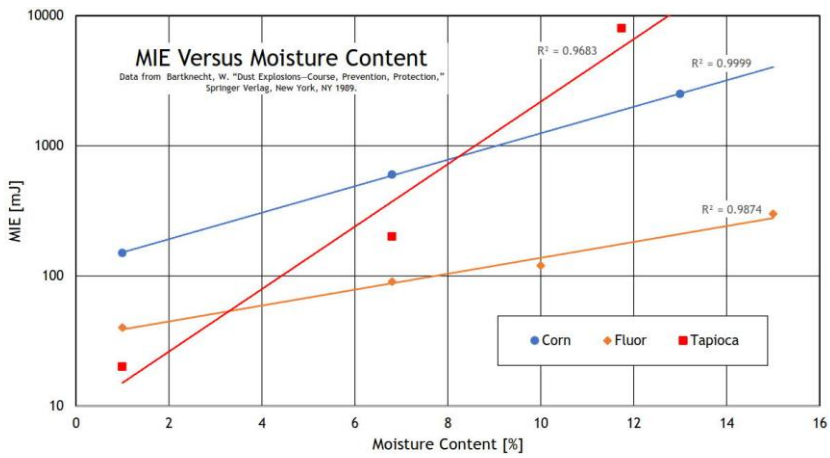


To find the actual MIE a much larger number of tests are required varying the test energy in much smaller steps and carrying out the test over a wide range of sample sizes. However, since the MIE is also a function of particle size and moisture content as shown in the graphs to the left and below, it is unlikely that the additional cost of this extra testing will be worthwhile for most industrial plants.

On the other hand, the impact of particle size and moisture content on the MIE illustrates the importance of the use of laboratory testing instead of using published data. It is unlikely that published data will cover the particle size and moisture range of the actual materials being used.

Generally speaking, the MIE of dust is only directly relevant to electrical sparks from electrical apparatus and static electricity discharges. However, as will discussed in later blogs it is also relevant to other sources of ignition.

In the case of sparks from electrical equipment the simple conservative assumption to make is that such a spark will be an effective source of ignition no matter the MIE of the dust. In the case of a static electricity discharge the situation is more complex, with different types of discharges producing different spark energies. Human and isolated containers such as a metal drum can generate static electrical discharges greater than 10 mJ as can cone discharges. On the other hand, brush discharges are likely to be much less energetic. Static electricity as a source of ignition will be discussed in a later blog.



You can learn more about dust explosions and how to reduce the risk of a dust explosion occurring here:

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