



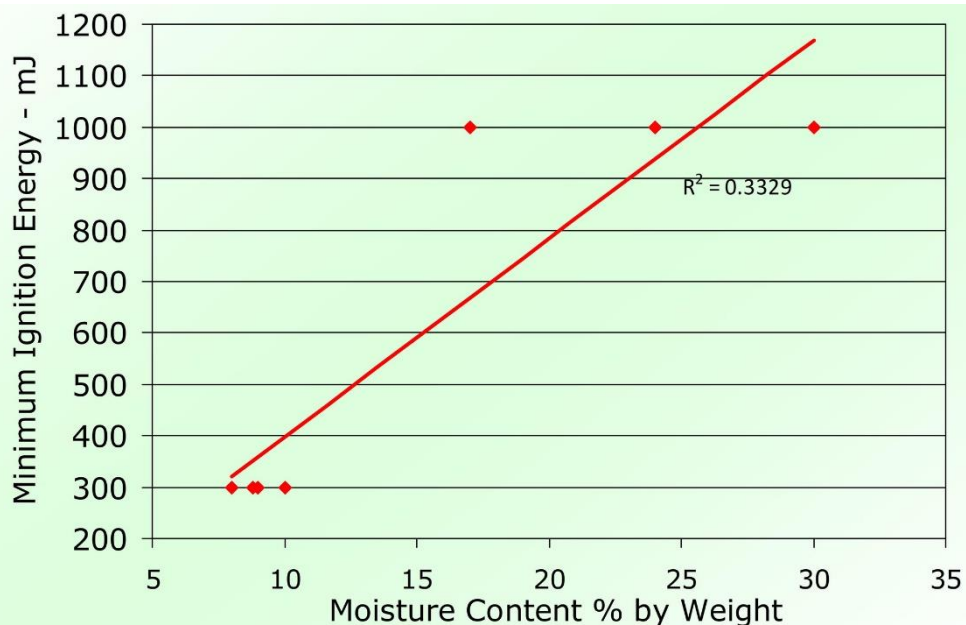
# Dust Explosions

## Step 1

### Is there a fuel present?

## Part 1 – No Explosion Properties on the MSDS - Ergo the Dust is not Explosive?

This is potentially one of the most dangerous assumptions that one can make. In my experience a material safety data sheet (MSDS) is a particularly poor source of information for the explosion properties of dusts.

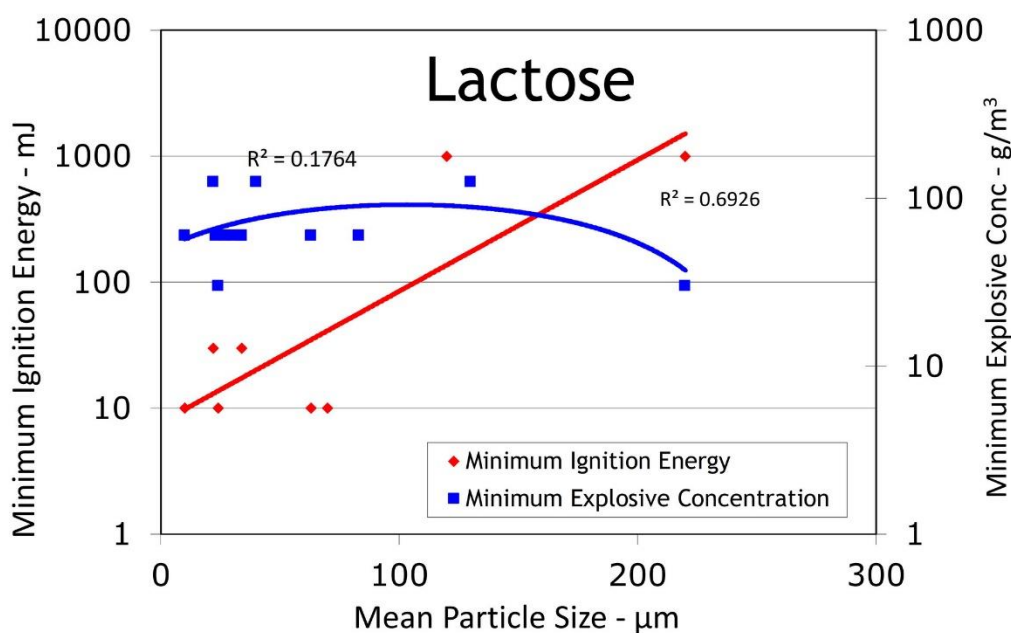


Source: BIA-Report 13/97 Combustion and explosion characteristics of dusts

Part of the problem is almost certainly related to the fact that dust explosion properties are not an absolute fixed property for a material, unlike many of the explosion properties for gases and vapours. In particular, dust properties are related to the particle size and the moisture content. This means that a dust with a large particle size and/or high moisture content may not be explosive but the same material with a small particle size and/or low moisture content may be explosive.



# My MINIMUM EXPLOSIVE CONCENTRATION



Source: BIA-Report 13/97 Combustion and explosion characteristics of dusts

recommendation would be that as a starting point one should assume that any material where 5% or more has a particle size less than 500 microns (including fibres with a diameter less than 500 microns) is likely to be explosive. The only exception is likely to be inorganic materials that do not include a nitrogen atom, but it does include graphite, carbon black etc.

## Where to find Explosion Properties

So, if an MSDS is not a good source of explosion properties, what is? One of the best sources of information that I have found is BIA Report 13/97 which is free to download from this webpage:

<https://www.dguv.de/ifa/publikationen/reports-download/bia-reports-1997-bis-1998/bia-report-13-97/index-2.jsp>

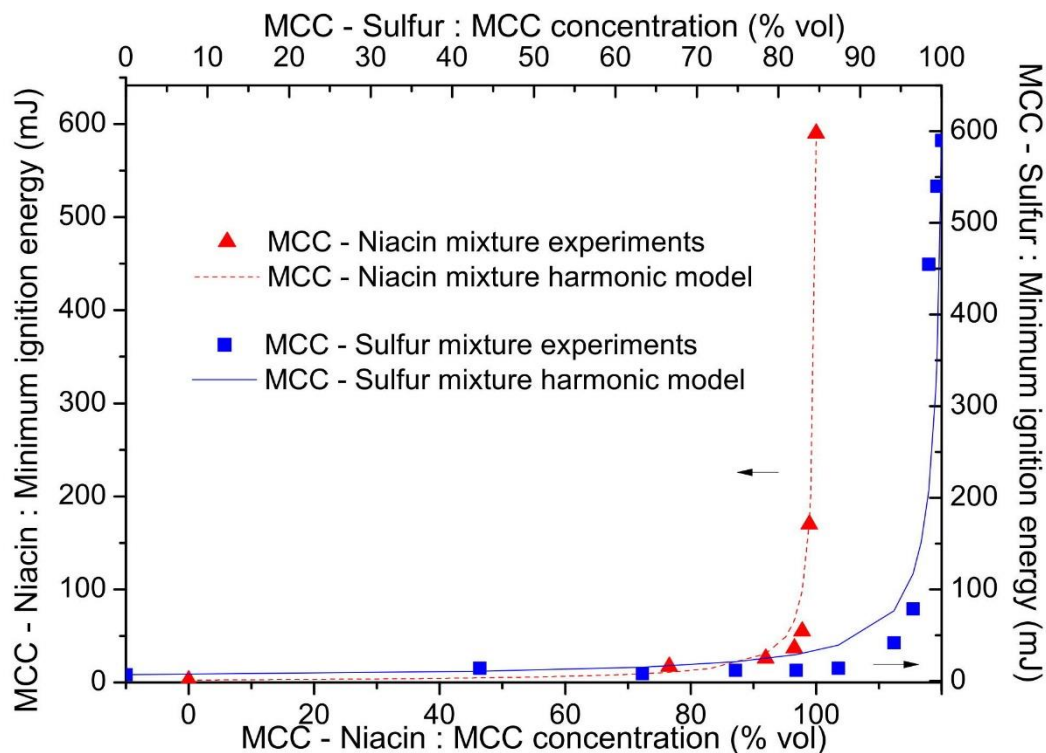
However, even this information comes with a caveat. As I said above, dust explosion properties are very dependent on particle size and moisture content, this means that the BIA report is unlikely to have the correct combination of particle size and moisture content and any information should be treated as indicative only and not used for design.

## Testing

So how do you get reliable dust explosion properties? In my experience the only way to do this is to have the material tested by one of the commercial testing laboratories. Since particle size and moisture content are important it is crucial to provide a representative sample. It is also important to discuss the testing method with the selected testing laboratory to ensure that the test method does not fundamentally change the nature of sample. For materials that are used in a very dry state, it is important the sample does not hydrate during the testing procedure.

## Mixtures

For mixtures, a working assumption is that the worst-case explosion properties should be taken even when the worst-case component is only a small percentage of the mixture. The diluent effort of less explosive materials is usually only effective when the concentration of most explosive material is less than 5%.



The graph above shows the impact of micro-crystalline cellulose on the minimum ignition energy for niacin and sulphur (from *When solids meet solids: A glimpse into dust mixture explosions.*)

Again, the best way to get reliable data for a mixture is to have the mixture tested. However, it is important to remember that many dust handling processes can lead to segregation, and this may cause the more explosive material to become concentrated in some areas, particularly when the more explosive material has a smaller particle size.

So, if you do not rely on MSDSs from manufacturers and you have a full set of explosion data for the powders you handle then that's excellent. On the other hand, if you do not, then I thoroughly recommend that you start doing some detailed research into the properties of the powders you are handling

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

### IChemE Online Training

<https://www.icheme.org/career/training/online-courses/dust-explosion-risk-reduction/>

<https://www.icheme.org/career/training/online-courses/dust-explosions/>

### YouTube Videos

<https://www.youtube.com/embed/kWvgTKh3RtY>

<https://www.youtube.com/embed/k0cqo0hANK0>