Combustible Dust Characterization Testing

The Science of Combustible Dust Testing

Each dust compound has unique physical and chemical characteristics. A good understanding of both is essential to understand the hazards, and ultimately the risks, associated with the dust being handled.

Identifying Dust Hazards

A typical first step to assessing a hazard level is to review information in the literature. In the case of combustible dust hazards, dust characteristics directly affecting combustibility hazards are a function of process-specific conditions such as concentration, size and shape, moisture content, and dispersion method and duration. Proper characterization of dusts must then be based on testing data of an actual sample from the process.

Chemical characteristics include items such as flammability and explosibility, as well as thermal degradation, instability, sensitivity to ignition and chemical reactivity. Depending on the type of process unit being analyzed and the potential explosion prevention measures to be employed, a testing plan is selected.

Experienced Professionals

ioKinetic has extensive experience with the evaluation and interpretation of dust hazard test data. We can assist with the development of a cost-effective test plan to characterize dust hazards. Let us help you sift through the complicated list of tests to determine which are appropriate for your operations. After the test is conducted, our experts will evaluate and interpret the data and provide a report of the results. We can offer a single package that includes test plan development, testing and data analysis, and interpretation. Our experts will work with you to determine the level of analysis that is required for your particular needs.

Available Testing

- Explosion Severity Test (KSt, Pmax, (dP/dt)max)
- Minimum Ignition Energy (MIE)
- Minimum Auto-Ignition Temperature (MAIT) of Dust Cloud in Air
- Minimum Explosible Concentration (MEC) of Dust in Air
- Limiting Oxygen Concentration (LOC) Test
- Hot-Surface Ignition Temperature (HSIT) of Dust Layer
- Volume Resistivity and Measured Charge Relaxation Time
- Electrostatic Charging (Chargeability) Test
- Chemical Reactivity/Calorimetry Testing

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Dust Hazards Analysis Testing

Available Testing

Explosion Severity Test (P_{max} & K_{st})

The testing will be performed per ASTM E 1226, "Standard Test Method for Pressure and Rate of Pressure Rise for Combustible Dust". The values of P_{max} and K_{St} are used to define the degree of explosibility of a material in terms of the total pressure to be generated in an explosion and the rate at which that pressure is generated. These values are applicable to the design of protective measures, such as deflagration venting per NFPA 68, VDI Method 3673 or ISO Method 6184. The value of CW is used in calculating allowable threshold quantities for dust hazard area determination. The test will be conducted using a spherical 20-L Siwek chamber.

Minimum Ignition Energy (MIE)

The testing will be performed per ASTM E 2019, "Standard Test Method for Minimum Ignition Energy of a Dust Cloud in Air" (this standard is very similar to British Standard 5958, 1991 and European Standard: IEC 1241-2-3, 1994). This test is recommended to quantify the electrostatic ignition hazard. The MIE value determines precautions needed in filling, blending and other particulate handling operations. This method provides a procedure for performing laboratory tests to determine the minimum ignition energy of a dust cloud. The test will be conducted in a modified 1.2-liter Hartmann chamber.

Minimum Auto Ignition Temperature of Dust Cloud in Air (MAIT)

Testing will be performed per ASTM E 1491, "Standard Test Method for Minimum Autoignition Temperature of Dust Clouds". The test method provides a procedure for performing laboratory tests to determine the minimum autoignition temperature (MAIT) of a dust cloud. It is most applicable to operations involving high temperature. The test will be conducted in a BAM furnace.

Minimum Explosible Concentration (MEC) of Dust in Air

Testing will be performed per ASTM E 1515, "Standard Test Method for Minimum Explosible Concentration of Combustible Dusts". The test method provides a procedure for measuring the minimum concentration of a combustible dust (dispersed in air) that can propagate a deflagration. It is most applicable to pneumatic transport of combustible dusts in low concentrations. The test will be conducted in a 20L chamber.

Hot Surface Ignition Temperature in a Layer (HSIT)

The test is conducted in accordance with ASTM E2021 "Standard Test Method for Hot Surface Ignition Temperature of Dust Layers". This test method is used to determine the minimum temperature at which a layer of dust will ignite. The parameter measured is the minimum hot surface ignition temperature in ˚C. Data obtained from this test method provides a relative measure of the surface temperature that will ignite a dust layer. The results can be combined with the MAIT results to specify maximum temperatures of equipment/operations in combustible dust atmospheres.

Volume Resistivity and Charge Relaxation

The volume resistivity test is conducted per ASTM D257-99, "Standard Test Method for D-C Resistance or Conductance of Insulation Materials" modified for powder application. The test measures the resistance of a

particular powder to electrostatic discharge in a layer form. The charge relaxation test is conducted to measure the amount of time required for a charge on a material to dissipate to approximately 37% of its initial value.

Burn Rate

The test is conducted in accordance with 49 CFR Ch. I Pt.173 App. E "Guidelines for Classification and Packing Group Assignment of Class 4 Materials". This test method is used to determine the rate of combustion propagation of a combustible dust layer. The parameter measured is the burn rate in mm/sec. Data obtained from this test method provides a relative measure of how rapidly combustion will propagate through a layer of material once ignited.

Limiting Oxygen Concentration (LOC) Test

Testing will be performed per ASTM proposed standard. The tests will determine how much inert (nitrogen atmosphere) is needed to prevent an explosion from occurring when the dust concentration is in the explosive range. Greater than 200g of sample less than 75µm required.

Electrostatic Charging (Chargeability) Test

Testing will evaluate the tendency of the material to generate an electrostatic charge and to hold that charge.

Additional costs as needed:

Chemical Waste Disposal per sample
Grinding/Sieving to <75 µm as requested per sample

Reactivity/Calorimetry Testing

Testing will evaluate the chemical reactivity of pure components or mixtures of chemicals: ARC, DSC/DTA, TGA

Other Large-Scale Testing

Large-Scale Testing, Blasting Cap Test