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Kwality Colours
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Gujarat , India

Subject **Investigation of the combustion and explosion behaviour of dusty solids**

Initiator Kwality Colours, Mr. Kalpesh Jaju

Your email of
Your ref. 27.07.2015

Company Kwality Colours,
Gujarat , India

Test Report No. 201522548

Solids designation **Specimen No.**	Dust state								Characteristic parameters of stirred-up dust							Characteristic parameters of deposited dust	
	Test fraction	Grain size distribution µm						Median value	Moisture	Lower explosion limit	Max. explosion pressure	K_{St}-value	Dust explosion class/ explosibility	Limiting oxygen concentration	Minimum ignition energy	Ignition temperature	Glow temperature	Combustion behaviour
		<500	<250	<125	<63	<32	<20											
	µm	WT %						µm	Wt %	g·m^{-3}	bar	bar·m·s^{-1}		Vol.-%	mJ	°C	°C	CN
Jhilmil - Brillianto+ / Royal Plus - Holi Colour Powder. Mixture of 10 colours (Green, Yellow, Golden Yellow, Chrome, Orange, Pink, Red, Purple, Sky Blue and Royal Blue) Specimen No. 201522548-01	Orig.-Subst.	100	100	100	94	67	45	22	5,1	500			St 1			410		2

The results only refer to substances corresponding to the sample sent in. An explanation of the table of results and of the test methods can be found enclosed.

Remarks: -

Yours sincerely **IFA Division 3** **Hazardous substances: Handling, protective measures** **By order**

Dr. Klaus-Werner Stahmer

IFA
Institut für Arbeitsschutz der
Deutschen Gesetzlichen Unfallversicherung

INVESTIGATION OF THE COMBUSTION AND EXPLOSION BEHAVIOUR OF DUSTY SOLIDS

Explanation of the table of results

Dust state

The details of the grain size distribution, median value and moisture describe the state of the dust as supplied and the state of the test specimen. The results in the following columns refer in all cases to the dust state given in the same line.

Lower explosion limit, maximum explosion pressure, K_{St}-value

The details of the lower explosion limit, maximum explosion pressure and K_{St}-value refer to tests in closed test apparatus in accordance with VD1 2263, Part 1, Sections 2.2 and 2.3 (1 m^3 vessel or 20 l sphere). In some cases, the tests cannot be carried out on the required scale (e.g. due to insufficient dust quantities). In cases where it makes sense, the values obtained for the maximum explosion pressure and K_{St}-value are given in brackets as a guide. If the lower explosion limit is only quoted in connection with the dust explosion class (without details of the maximum explosion pressure and K_{St}-value), the value supplies the relevant concentration from tests in modified Hartmann apparatus as a guide.

Dust explosion class/Dust explosibility

The dust explosion class is derived either from the K_{St}-value obtained or from tests in modified Hartmann apparatus. The relationship between the K_{St}-value and dust explosion class is shown by the following table:

Dust explosion class	K_{St} [bar·m·s^{-1}]
St 1	> 0 to 200
St 2	> 200 to 300
St 3	>300

Details in brackets, e.g. "(St 2)" or "(St 3)", refer to tests in modified Hartmann apparatus. These serve merely as a guide, even if they generally include a large safety margin. In such cases, however, further tests in closed apparatus are always necessary.

If more precise details are not possible, e.g. because of insufficient quantities of dust, but the sample is definitely reactable, "Yes" is merely given for dust explosibility.

"No" (no dust explosibility) is a very far-reaching statement which can only be made if either no exothermic reaction is possible owing to the chemistry of the substance or if exhaustive tests on fine dust in closed apparatus in accordance with VDI 2263, Part 1, Section 2.1.2 have not shown any characteristic pressure build-up.

Deutsche Gesetzliche Unfallversicherung e.V. (DGUV)

Spitzenverband der gewerblichen Berufsgenossenschaften und der Unfallversicherungsträger der öffentlichen Hand

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Limiting oxygen concentration
The limiting oxygen concentration is determined in accordance with VDI 2263, Sheet 1, Section 2.4. Nitrogen is always used as the inert gas. If other inert gases are employed, this is mentioned explicitly, e.g. "12 (CO_2)". In some cases a pair of values is given instead of an individual value for the limiting oxygen concentration. In such cases the maximum oxygen concentration at which no further reaction takes place in tests is given along with the lowest oxygen concentration at which reactions are still observed (e.g. "> 1 0/< 1 2").

Minimum ignition energy
The values for the minimum ignition energy are based on tests in accordance with VDI 2263, Sheet 1, Section 2.5 and VDI Progress Report No. 134. A pair of values is always given with a logarithmic scale. The first value is the maximum energy at which there was no ignition over a broad concentration range in ten successive tests. The other value is the lowest energy at which ignition was still observed. The details "> 10/< 100" mean that the actual value is between 10 mJ and 100 mJ. If only one value is given (e.g. "<10" or ">10^4"), no tests were carried out with lower or higher ignition energy. In practice, however, such values are generally sufficiently informative.

If the minimum ignition energy is determined not only with the prescribed method, but also without inductivity in the discharge circuit, the result is supplemented accordingly (e.g. "> 100/< 10^3 without ind."). Minimum ignition values > 10^5 mJ are derived from tests in closed test apparatus with the use of suitable chemical igniters.

Ignition temperature (minimum ignition temperature of a dust cloud)
The ignition temperature is always determined in accordance with VDI 2263, Sheet 1, Section 2.6 in the BAM furnace. Depending on what is being investigated, the test can also be carried out in a Godbert-Greenwald furnace, in the normal or long version. In such cases, the result is supplemented accordingly (e.g. "G-G" or "G-G long"). The abbreviation "NIB ..." means "No ignition below ...°C".

Glow temperature (minimum ignition temperature of a dust layer 5 mm thick)
Glow temperature is determined in accordance with VDI 2263, Sheet 1, Section 1.3. For thicker dust layers, ignition may occur at considerably lower temperatures in some cases. The abbreviation "NGB ..." means "No glow below ...°C". The term "melts" indicates that the substance melts or sinters to such an extent before glow temperature is reached that it no longer qualifies as a dust.

Combustion behaviour
Combustion behaviour is determined in accordance with VDI 2263, Sheet 1, Section 1.2. Combustion behaviour is assessed with the combustion numbers CN 1 to 6, with the following classification:

CN 1	No ignition
CN 2	Brief ignition, rapid extinction
CN 3	Local burning or smouldering without spread
CN 4	Spread of a smouldering fire
CN 5	Spread of an open fire
CN 6	Explosive combustion

The values given in brackets refer to a farther-reaching test in which 20 wt % diatomaceous earth is added to the solid. This method also permits an assessment of melting substances.