# Scaling up metal dusts deflagrations severity

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# Scaling up metal dusts deflagrations severity

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**Abstract**

Most of the dust explosions reported in the past have involved organic products, mainly because most of the combustible materials in commerce are organic, particularly agricultural fuels. The rate of explosion obtained has often been expressed as a so-called and cubic law, as the product of the rate of pressure rise and the cubic root of the vessel volume $K_{St} = (dP/dt).V^{1/3}$, which is widely used to design explosion protection techniques.

More recently, metal dusts have been involved in a striking number of severe incidents. These materials exhibit rather different combustion characteristics, which are not sufficiently well described in the dust explosion literature.

In this paper, we report experimental measurements on the explosion severity for well characterized metal powders commonly used in the industry. Systematic experiments have been performed, varying dust concentration, and vessel volume (20-l sphere and 1-$m^3$ chamber). Experiments in larger vessels have also been performed.

The results show that the cubic law is not sufficient to describe the volume dependence. Thermal radiation may be the main explanation for the observed discrepancies, and suggests further directions in the derivation of scaling laws for high temperature dust flame deflagrations. It also emphasizes the potential overdriving effect of chemical igniters on fine reactive powders.

*Keywords: dust, deflagration, scaling, metals, deflagration severity, $K_{St}$, cubic law.*