Experimental study on the correlation of dustiness with measured particle and bulk properties for limestone powders with different particle size using a vortex shaker

Somik Chakravarty[#,*], Martin Morgeneyer[*] and Olivier Le Bihan[†]

[*] Université de Technologie de Compiègne (UTC) – Sorbonne Universités,
Laboratoire Transformations intégrées de la matière renouvelable (TIMR),
Rue Roger Couttolenc, CS 60319, 60203 Compiegne Cedex, France
e-mail: somik.chakravarty@utc.fr, web page: http://www.utc.fr/

[†]Institut National de l'EnviRonnement Industriel et des RisqueS (INERIS),
NOVA/CARA/DRC/INERIS, Parc Technologique Alata,
BP2, F-60550 Verneuil-En-Halatte, France

Key words: Dustiness, Vortex shaker, Limestone powders, Bulk mechanical properties

ABSTRACT

Growing concerns over safe and efficient handling and transportation of bulk materials in industry have pushed towards analysis of powders and their tendency to generate dust upon handling, known as its dustiness. Growing use of nanopowders in industry has further increased the complexity associated with handling and conveying potential toxic and expensive nanomaterials. Dust released from handling of bulk materials depends on the handling process as well as the material itself. This communication focusses on the influence of particle and bulk material properties on the dustiness of limestone powders with known particle sizes and distribution. The particle and bulk mechanical properties considered for this study include particle density, porosity, flowability and bulk density of the test powders.

The experimental study of dustiness used the vortex shaker method [1] to generate dust from the eskal series of limestone powders. The powders used were eskal-15, 150, 300 and 500 obtained from KSL staubtechnik gmbh with mean particle size ranging from 1.2µm to 135µm. The eskal powders are used as a standard test powders and are known for their temperature insensitiveness and non-hygroscopic properties. The eskal series of powders will be extensively used as reference powders under the T-MAPPP Marie Curie Initial Training Network (2013-2017) sponsored by the EU.

The experiment was carried out in an isolated chamber with controlled temperature, humidity and pressure maintained for each of the test samples. Dustiness analysis of these powders involved characterisation of the particle number concentration and the particle size distribution of the aerosolized dust. Results are presented to highlight the correlation of dustiness for each test powder with the measured particle and bulk mechanical parameters for limestone powders of different particle size and distribution.

The results from all sets of experiments were correlated to establish a hypothetical relationship between the powder properties and their dustiness. Further study is recommended to elucidate the effects of different material properties on the dustiness of powders, with an aim of developing a predictive model to analyse powder dustiness.

References

[1] Morgeneyer, Martin, Olivier Le Bihan, Aurélien Ustache, and Olivier Aguerre-Chariol. "Experimental study of the aerosolization of fine alumina particles from bulk by a vortex shaker." *Powder Technology* 246 (2013): 583-589.