**Rheological study of binary mixtures of powders using interparticular forces**

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This study has been carried out in order to improve the understanding of the mechanisms that occur during powder mixing operations, which are commonly used in many industrial processes. Up to now, the link between physicochemical and morphological properties of the powders and its flowability is still unclear. Likewise, for a mixture of several powders of different particle properties, the influence of the mass fraction of each powder within the mixture on its resulting rheology is not clearly established.

For this study, alumina (Al2O3), zircon (ZrO2) and yttrium oxide (Y2O3) powders of different grades have been selected in order to get a relevant range of size and shape for the study. The mixtures are prepared in a Turbula® mixer and the flowability of each blends has been assessed by Jenike shear cell yield locus measurements, performed with a powder rheometer.

A model linking the flowability of the mixtures to their composition and the morphological properties of each powder has been investigated using a population dependent Bond number which has been developed in previous studies [1]. This dimensionless number corresponds to the ratio between adhesive interparticular forces and the weight of the particles within the powder. It is then linked to the overall cohesion of the powder bed (Figure 1). The population dependent Bond number is assessed by fine characterization of each powder in terms of size distribution, surface roughness, specific surface area, surface energy and true density.

Figure 1 : Evolution of the flow index regarding the formulation of binary mixtures of alumina and yttrium oxide powders

[1] M. Capece, K. R. Silva, D. Sunkara, J. Strong, and P. Gao, “On the relationship of inter-particle cohesiveness and bulk powder behavior: Flowability of pharmaceutical powders,” Int. J. Pharm., vol. 511, no. 1, pp. 178–189, Sep. 2016.