Experimental Investigation of Limestone Powders using Different Shear Devices

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Granular materials are ubiquitous in our daily life. A special class is powders that contain very fine particles that may flow freely when shaken or tilted, but stick when left at rest or compressed. During storage and transportation in powder processing industry, the material faces various stress conditions, due to compression or shear. A topic of particular relevance from the application point of view is yielding, i.e. when powders start to flow under shear, or what is the necessary shear stress to keep them flowing. Physical experiments are carried out on fine limestone powders in three shear devices (direct shear box [1,2], Schulze ring shear tester [3] and FT4 powder rheometer [4]) to investigate different material behaviors and instrumental influence on the observations or measurements. The difference between the yield stress (transition from static to flow) and the steady state shear stress (required to maintain shear motion) is also included.
Interesting minimum plateaus are found on the angle of internal friction both during incipient flow and steady state flow when increasing particle size. The bulk density in steady state is increasing with increasing the particle size. Further investigations involving span of particle size distribution, volumetric particle sphericity and scanning electron microscopy are also addressed. These experimental data will be further used in modelling of cohesive and frictional fine powders in DEM simulations [5].

Reference

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