

Powder properties influence on the local stress profile in a granular column

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3 - Propriétés et caractérisation

In a wet agglomeration process, inside a low shear mixer, the blade displacement allows for homogenizing the pulverized liquid on the powder surface and promoting the growth mechanisms of agglomerates. This mechanical action is efficient if the blade can apply an adapted stress field in the granular media. Low shear mixers with a vertical arm can cyclically mix the grain bed by alternating dynamic states of the particles close to the blade and static states beyond the influence length of the mobile. As a consequence, the blade displacement alternately disturbs the mechanical profile at equilibrium inside the powder bed which strongly affects the flowing powder properties once the powder is in movement. Until recently, the qualification of the static state of a granular media was described by Janssen's model, which under some hypotheses, allows calculating the stress at the bottom of powder column. Recent stress measurements, conducted by some of us, showed that Janssen's profile is different from the local stress profile.

The objective of this work is to experimentally measure the local stress profile inside a semi-confined granular bed with a force sensor immersed in the powder bed. Several reactive powders issued from durum wheat were selected to estimate the physical characteristic impact of the particles (size, angle of rest...). The results show that the shape of the local stress profiles is similar whatever the powder characteristics. The construction of the local profile is discussed according to a structuration of three layers in the powder bed, which seem to be separated by two characteristic lengths.