

# Elongated grains in a hopper

*CJOGF"OQJCOGF"CNK"CUJQWT"CJOGF".Vco "u"D<sup>3</sup>/4t/w<sup>3</sup>/4p{k."Gm<sup>a</sup>m"Uqohck."  
Dcn<sup>a</sup>/u"U/cd»3."Ucpftc"Ygipgt."cpf"Tenh"Uvcppctkwu*

## Abstract

Flow and clogging of granular materials in a 3-dimensional hopper is investigated experimentally.

We use X-ray tomography and optical methods to study this phenomenon for spherical and elongated particles.

The X-ray tomograms provide information on the bulk of the hopper filling, and allow to determine the particle

positions and orientations inside the silo, as well as spatial variations of the local packing density. We find that

particles show a preferred orientation and thereby an enhanced order in the flowing zone of the silo. Similarly

to simple shear flows, the average orientation of the particles is not parallel to the streamlines but encloses a

certain angle with them. The clogged state is characterized by a dome, i. e. the geometry of the layer of grains

blocking the outflow. The number of grains forming this blocking layer is larger for elongated grains compared

to the case of spheres of the same volume.

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