Particle shape matters -- Using 3D printed particles to investigate fundamental particle and packing properties

Whereas particle size and its importance is often stressed, the shape of particulate materials is often not considered in detail even though there is plenty of evidence that it is crucial for operations like transport, mixing, and fluidisation. In this study, we experimentally determine the influence of particle shape on fundamental bulk characteristics of process-engineering interest. Well-defined particles of seven different shapes but equal volume are used which are manufactured by selective laser sintering and their morphology is characterized by 2D image analysis. It is found that particles differ strongly in their packing and piling properties. These findings are exemplarily compared with performed DEM simulations where, using the same model parameters, no simple plug-and-play prediction to different shapes is possible. Thus, the current study closes the gap between ever more advanced simulation methods, considering also non-spherical particles, and the often oversimplified or undefined particle shapes encountered in experimental studies.