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Relationship between single and bulk mechanical properties for zeolite particles

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Abstract

In this work typical mechanical properties for a material zeolite, have been measured in order to relate the bulk behaviour of the powder material to the single particle mechanical properties. Particle shape and size distribution of the powders, determined by laser diffraction and scanning electron microscopy (SEM), confirmed the spherical shape of the particles. The excellent flowability of the material was assessed by typical methods such as the Hausner ratio and the Carr index. This was confirmed by bulk measurements of the particle–particle internal friction parameter and flow function using a Schulze shear cell, which also illustrated the low compressibility of the material. Single particle compression was used to characterize single particle mechanical properties such as reduced elastic modulus and strength from Hertz contact mechanics theory. Comparison with surface properties obtained from nano indentation suggests heterogeneity, the surface being harder than the core. In order to evaluate the relationship between single particle mechanical properties and bulk compression behaviour, uniaxial confined compression was carried out. It was determined that the Adams model was suitable for describing the bulk compression and furthermore that the Adams model parameter, apparent strength of single particles, was in good agreement with the single particle strength determined from single particle compression test.

Keywords*:Zeolite particle , Flowability, Powder flow functionEffective, Effective angle of internal friction, Schulze shear cell, Nanoindentation, Single particle compression, Bulk compressiona.*

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