abstract

This thesis investigated the effects of differing diameters and varying moisture content on the flowability properties of granular glass beads through use of a Freeman FT4 Powder Rheometer. These parameters were tested in order to construct an empirical model to predict flowability properties of glass beads at differing size ranges and moisture contents. The final empirical model outputted an average error of 8.73% across all tested diameters and moisture ranges.

Mohr’s circles were constructed from experimentally-obtained shear stress values to quantitatively describe flowability of tested materials in terms of a flow function parameter. A high flow function value (>10) was indicative of a good flow.

By testing 120-180 µm, 120-350 µm, 180-250 µm, 250-350 µm, 430-600 µm, and 600-850 µm glass bead diameter ranges, an increase in size was seen to result in higher flow function values. The limitations of testing using the FT4 became apparent as inconsistent flow function values were obtained at 0% moisture with size ranges above 120-180 µm, or at flow function values of >21. Bead sizes larger than 430 µm showed significant standard deviation over all tested trials—when excluding size ranges above that value, the empirical model showed an average error of only 6.45%.

Wet material testing occurred at all tested glass bead size ranges using a deionized water content of 0%, 1%, 5%, 15%, and 20% by weight. The results of such testing showed a decrease in the resulting flow function parameter as more water content was added. However, this trend changed as 20% moisture content was achieved; the wet material became supersaturated, and an increase in flow function values was observed. The empirical model constructed, therefore, neglected the 20% moisture content regime.