The FT4 Powder Rheometer® is a universal powder tester that provides automated, reliable and comprehensive measurement of bulk material characteristics on a wide range of powders.

Using customised Test Programs and bespoke accessory combinations where necessary, materials with a large particle size (in the millimetre range), or extreme aspect ratios, can also be successfully characterised. The resulting information can then be correlated with process experience to improve efficiency and aid quality control.

A VERSATILE APPROACH TO POWDER FLOW TESTING

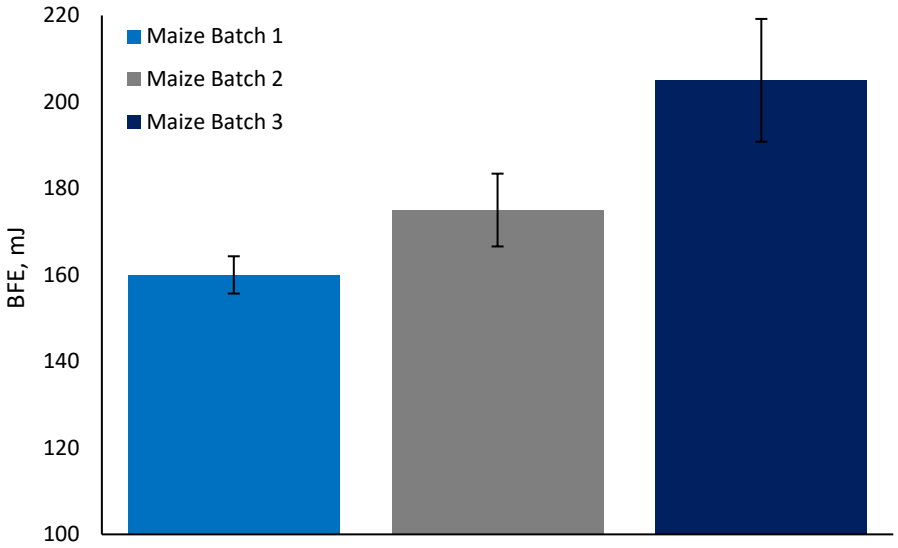
The FT4 uses different sized vessels and accessories sizes depending on the type and availability of materials being tested. When testing very large particles, these accessories can be used in varying configurations to address the associated challenges.

The flexibility of the Test Programs also enables aspects such as Blade Tip Speed, rotational direction and height range to be modified to suit the material being tested.

The following studies demonstrate the versatility of the FT4 in characterising the flow properties of challenging materials.

EXAMPLE DATA

Maize Kernels



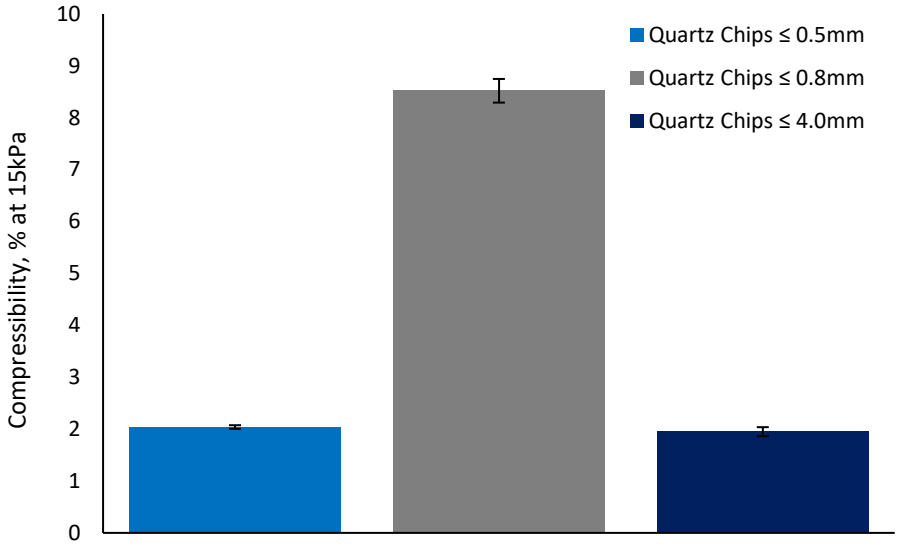
Three samples of maize kernels with average particle size between 8mm and 11mm were tested using the Dynamic Flow methodology, employing a 62mm internal bore vessel in combination with a 23.5mm Blade, to provide over 19mm of clearance between the blade and the vessel wall to prevent particle trapping.

The three samples generate clearly different BFE values, indicating that they would behave differently when subjected to dynamic, forced-flow such as in a grain ladder.

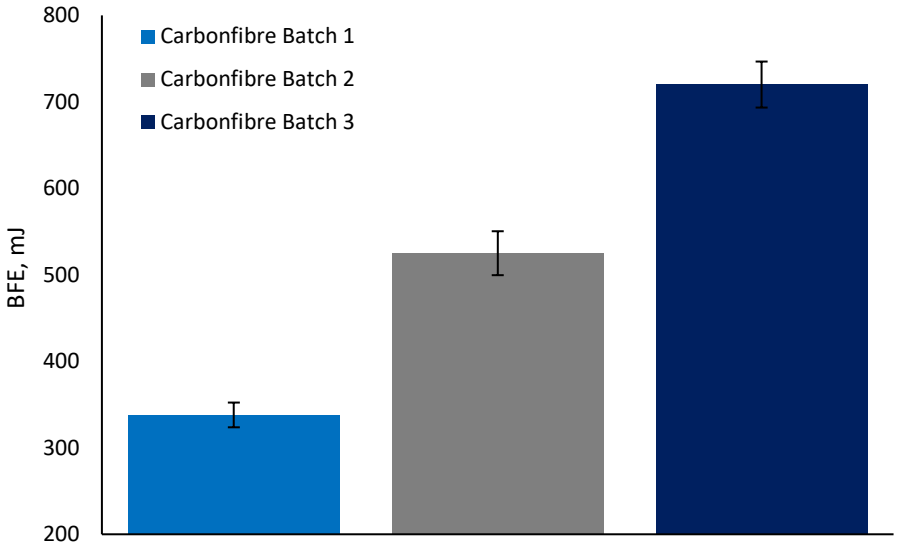
Quartz Chips

Three samples of quartz chips with D_{90} between 0.5mm and 4mm were tested with the Compressibility test, employing a 50mm internal bore vessel with a 23.5mm Blade for Conditioning and the standard 48mm Vented Piston for compression.

The quartz chips with a D_{90} of 0.8mm were considerably more compressible than samples with both smaller and larger particles, indicating that the flow properties were a function of more than particle size alone.



Carbon Fibre Strands



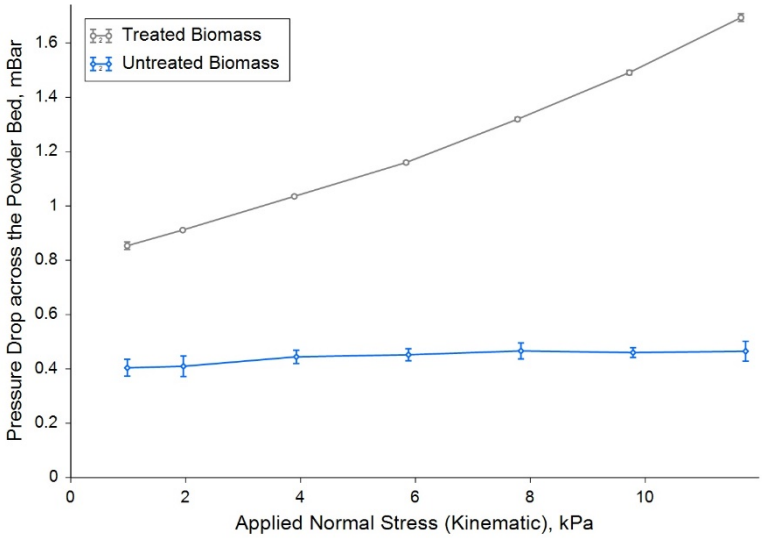
Three samples of carbon fibre strands with an extreme aspect ratio (around 250:1, strand length around 25mm) were tested with the Dynamic Flow methodology, employing a 62mm internal bore vessel in combination with a 23.5mm Blade. The Test Cycle was further modified to incorporate a shallow helix angle and reduced height range to minimise compaction of the strands against the base of the vessel.

Clear differences were found between the three batches, indicating that they would present a different bulk resistance to forced flow depending on the circumstances.

Biomass Materials

Two samples of fibrous biomass, one treated to partially dissolve the cellulose fibres as a precursor to bio-ethanol production, were tested with the Permeability methodology, employing the standard 62mm accessories and an increased air velocity of 25mm/s to maximise the Pressure Drop across these highly permeable materials.

Both samples are highly permeable, as demonstrated by the very low Pressure Drop despite the high air throughput, but the Treated sample generates a higher value, indicating lower permeability. The Treated material is also markedly more sensitive to increasing stress, exhibiting significant increase in Pressure Drop as the sample is compressed.



CONCLUSIONS

Powder flowability is not an inherent material property, but refers to the ability of powder to flow in a desired manner in a specific piece of equipment. In bulk handling industries, it may be necessary to understand the relationship between the process and materials that are challenging to characterise using traditional powder testing techniques.

The FT4 is capable of testing a wide range of powders using its standard test methodologies. However, when testing particles of a large size or with a high aspect ratio the flexibility of the FT4 allows modifications to be made enabling clear and repeatable data to be generated on challenging materials. Evaluating the resulting range of process-relevant properties enables process engineers to understand how materials vary, and the impact this will have processing and handling.

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