# Multi-variate Powder Characterisation for Predicting Screw Feeder Performance

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Despite the widespread use of screw feeders to control the flow of powder between the stages of a process, the prediction of feed rates is heavily dependent on engineering estimation based on pre-existing performance information and extrapolation. Failure to identify suitable feed rates for particular materials can result in sub-specification operation and the use of equipment that does not meet design requirements, therefore a reliable alternative is required.

A potential solution is to employ automated, multi-variate powder characterisation tools, which can provide reliable measurement of a powder's response to a variety of different process relevant conditions. The data from this comprehensive characterisation can be correlated with process performance information to improve feeder efficiency and ensure the production of high quality products at desired rates.

Five diverse powders were conveyed through two different screw feeders, DIWE-**GLD**-87 VR (a full flight, single-screw feeder) and DIWE-**GZD** (a flat bottomed, double-screw feeder), to determine their volumetric feed rates. An FT4 Powder Rheometer® (Freeman Technology Ltd) was also used to assess the dynamic flow, bulk and shear properties of the materials. The relationships between volumetric feed rate and the rheological properties of the powders were analysed using Multiple Linear Regression (MLR).

MLR analysis identified trends between feed rate and several FT4 parameters. The testing of two additional materials provided further evidence of these relationships and reinforced the models defined by MLR. A clear relationship was demonstrated between GLD volumetric feed rate and Specific Energy (SE) and Flow Rate Index (FRI). A trend was also observed between GZD volumetric feed rate and Aerated Energy (AE).

The different screw feeders generate different processing conditions therefore it was expected that performance in each would be dependent on different rheological parameters. This emphasises the requirement for multi-variate powder characterisation, also stressing the importance of measuring dynamic flow properties. The relationships studied between rheological properties and feed rate have demonstrated that it's possible to generate design spaces that could be used to predict performance without incurring the overheads associated with running materials through a full-scale process.