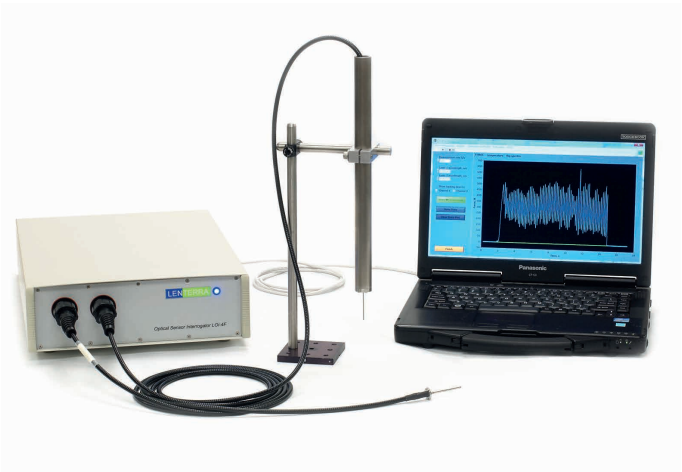
LENTERRA Flow Sensor (LFS) System

INNOVATION BY ANY MEASURE



Freeman Technology are the worldwide exclusive distributors of Lenterra products.

The LFS system consists of a Drag Force Flow (DFF) sensor, the Lenterra Optical Interrogator (LOI) and a ruggedised laptop with bespoke software.

The system provides an in-line, real-time assessment of powder flow enabling improvements in process understanding and manufacturing efficiency in various industries.

FEATURES

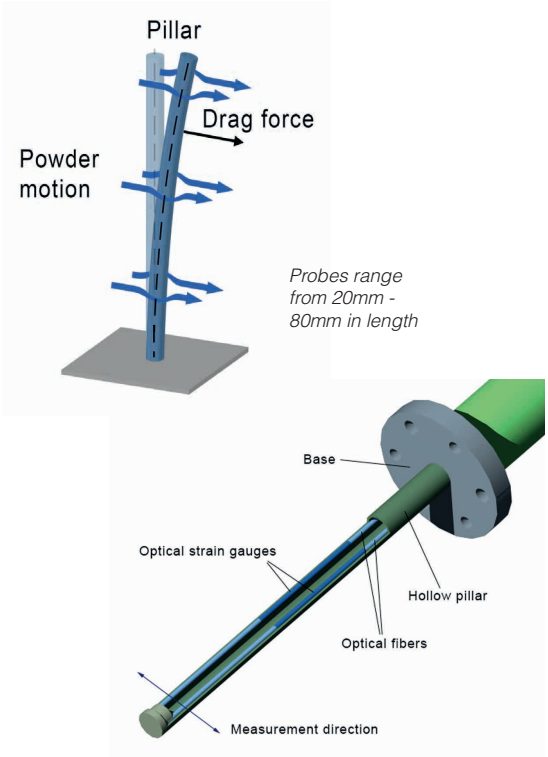
- In-line, real-time measurement of material properties and temperature
- Multi-directional sensitivity
- Chemically resistant construction
- Fibre optic connectivity

APPLICATIONS

- High Shear Wet Granulation
- Blending
- Feeding
- Spray drying / drying
- Flow rates in pipes and transfer chutes

BENEFITS

- Robust Process Analytical Technology (PAT)
- Enhance process understanding
- Improve product quality and consistency
- Optimise cycle times
- Increase product throughput
- Accelerate / simplify scale-up
- Minimise 'out of specification' material and rework
- Improve compliance
- Reduce costs (rework, resample, retesting etc.)



HOW IT WORKS

The DFF sensor consists of a hollow pillar mounted on a stationary base, containing two optical strain gauges, Fibre Bragg Gratings (FBGs). The LOI is connected to the FBGs via a fibre optic cable and continuously monitors the FBG spectra. When the pillar is deflected by flow, one FBG becomes extended and the other one is compressed, leading to a shift in wavelength spectra. A larger deflection results in a greater shift.

When the probe is immersed in a moving powder or material, the DFF sensor bends under the force of the flow. The magnitude of the deflection is continuously measured and quantifies the drag force in real-time, which is a function of material properties such as size, density, adhesion and strength, allowing operators to assess material properties in-process.

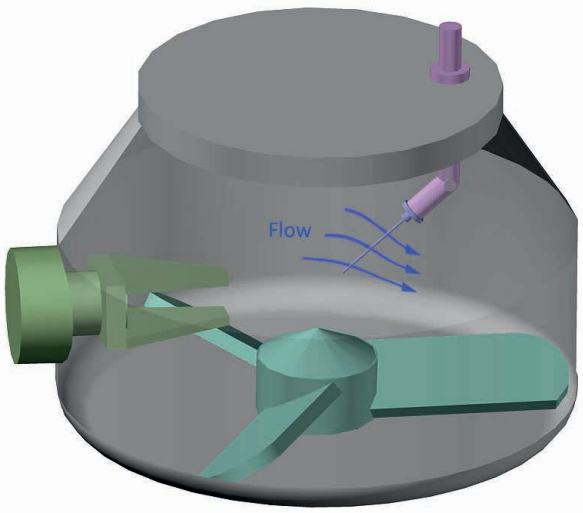
APPLICATION - HIGH SHEAR WET GRANULATION

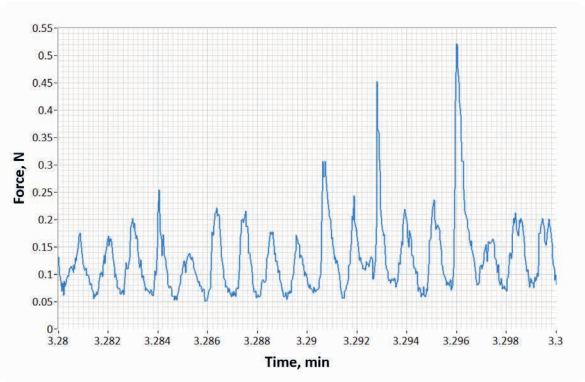
High Shear Wet Granulation (HSWG) is widely employed in many industries. Effective management of HSWG processes requires an understanding of granule evolution and the impact of changing properties.

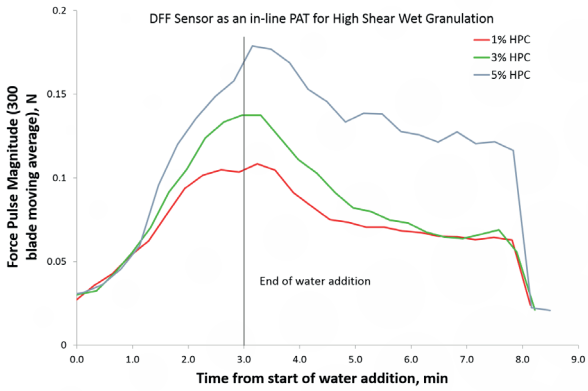
The DFF sensor delivers valuable information to assist formulation and process development, as well as for routine monitoring, control during manufacturing, and scale-up strategy. The data below illustrates how the technology can be used to robustly track a granulation process, enabling the user to monitor granule evolution without disrupting the process.

Advantages of the DFF Sensor

- Ability to assess properties of the granulated wet mass without halting the process
- Measured FPM signal relates to wet mass consistency and granule densification, delivering significantly more information than granule size distribution alone
- Determine the effect of process parameters on granule properties (e.g. impeller speed/time, water content)
- Able to identify and quantify minor batch-to-batch variations with comparable formulations
- Accurately track each stage of granulation process
- Can be used to define granulation end-point – enabling robust formulation development as well as process design and control
- Supports efficient scale-up of wet granulation processes







The principal output of the Drag Force Flow sensor for powder mixing applications, including granulation, is the Force Pulse Magnitude (FPM). Force data resulting from impacts on the probe are recorded and divided up into sub-arrays, FPM values are calculated from the difference between the minimum and maximum force in each array. Therefore, FPM data enables the operator to evaluate changes in the physical properties of the powder blend, for example wet mass consistency and densification, without the signal being influenced by the passage and position of the blade/impeller.

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