LASER granulometer

LASER granulometry dates back to the 1970s, it is a technique for measuring the size of particles or more precisely their rays and also for determining their grain size frequency.

LASER granulometry makes it possible to measure sizes between 0.05 and 900µm, it is therefore particularly suitable for polymer suspension and all types of mineral powders.

Principle

LASER granulometry is a technique grounded on light diffraction. It is based on the Fraunhofer theory, using the following hypotheses :

- Spheric particles are considered to be non porous and non opaque. These particles have a diameter which is superior to their wave length. The particles are in constant random motion.

The particles diffract light efficiently regardless of their size. When a laser beam sheds light on a particle, diffraction patterns can be observed. According to Fraunhofer, the intensity of the diffracted radiation and the deviation differ according to the size of the particles.
The larger the particle, the more light it will deviate and the weaker its deviation angle in relation with the propagation will be.

The above theory is nonetheless limited, it can not be applied to particles whose size is superior to their wave length. If a particle's diameter is inferior to its wave length, the theory of Fraunhofer is no longer valid and the theory of Mie is used instead; which is based on the assumptions of Rayleigh.
According to this theory, the laser beam is assumed to not only be diffracted by the particles, but is also reflected and diffused. The light will spread until there is a variation in the refraction index of the propagation environment.

This index variation will create a refraction of the monochromatic beam, the laser will reach the detector having been subjected to several variations in its propagation direction.

Consequently, the theory of Mie requires a certain knowledge as regards the optical properties of the particles and of their dissipation environment.

Applications

The first step is to dilute the sample. The apparatus will then measure the background noise in order to record the diffraction phenomena caused by the watersolvent.

Then the sample solution is injected into the measuring cell, each particle that passes through the radiation beam deviates the light which is then analysed by detectors, then the results are dealt with by calculations on inverted matrices.

Readings are obtained quickly, as it only a few seconds are required to capture 2000 to 4000 times the light beams scattered by thousands of particles passing simultaneously through the laser beam.

Equipment

The laboratory at CRITT Matériaux Alsace with a MALVERN MASTERSIZER laser beam granulometer which is for wet measurements of granulometric powder distribution (size of particle size ranging from 0.05 to 9000µm.

The machine is equipped with an optical bench, two wet sample dissolvers, one recycling measuring cell and a data processor coupled with MALVERN MASTERSIZER software.