On-line characterization of micro- and nanostructured materials in Process Analytical Technology (PAT)

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PAT focusses on process monitoring, which is driven by industry for economic reasons and legal authorities for the sake of consumer safety (e.g. Hazard analysis and critical control points (HACCP) in food industry). Its application focusses on observing the progression of reactions and processes (in batches) as well as controlling process stability (continuous processes). The process monitoring encompasses the continuous observation of product streams or batch processes. This monitoring is involved in complicated physical-chemical condition and process control parameters (e.g. no chance of repeating the measurement, typically harsh conditions, high polydispersity and multiple particle species).

It is important for the PAT that applications of the process analyser concentrate on real time measurement (on-line, in-line and in-situ [1]) in the process and not on measuring situation with time delay or separated from process in time and location (off-line, at-line). This different measuring situation requires measuring methods based on different measurands, for particle size and material composition, i.e. equivalent diameters, and also on different types of quantity of particle size distribution (PSD).

An overview of the state of the art related to research about on-line analytic processes is important in order to understand and compare the advance of the techniques for the determination of physico-chemical properties of matter (e.g. zeta potential). For the characterization of micro- and nanostructured materials targeting the improvement of PAT, the present study contains complete information about the relevant research and implementation of new measurement methods such as imaging methods (e.g. Dynamic Image Analysis (DIA)[2][3] and Particle Vision and Measurement (PVM)[4] versus traditional sizing techniques for process monitoring such as laser diffraction (LD)[5] and acoustic spectroscopy [6].

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