

## Abstract

There is a growing requirement for on-line instrumentation for the testing of particulate mixtures during manufacture. Conventional technologies are limited in their application or in respect of the quantity of information they can provide. Often product evaluation must still be carried out off-line, greatly increasing production costs in terms of wasted time, additional reagent storage and reduced throughput. A technology which can replace costly off-line testing with a reliable on-line system is therefore an important development for industry.

Ultrasound offers the possibility of on-line evaluation of the state of a particulate mixture where other techniques may be unsuitable. In order for measurements to be made quickly, to assess the state of a product throughout its manufacture, real-time signal processing and display of ultrasonically derived data is required, and software has been developed to accomplish this. Industrial particulate mixtures are often highly corrosive or abrasive, and a new spectrometer system based on stainless steel test-cells has been developed to test such products, with a view to extending their role from the laboratory to on-line measurement in process plant.

A number of industrially relevant particulate mixtures including textile dyes and agrochemicals have been successfully tested using the instrumentation presented in this thesis. Where possible, the experimental results have been compared to an accepted ultrasonic compression wave scattering model (Allegra and Hawley 1972). A purpose designed temperature controller has been developed for the control and monitoring of crystallization processes, allowing ideal temperature curves for cooling crystallizations to be closely followed.