of flow ability measurement have not been suitable as a basis for repetitive testing. In all traditional techniques, the packing condition and the air content are largely unknown quantities, and so, the results will vary accordingly. When making an assessment, it is essential to know what was tested and the condition of the powder when tested. In addition to the packing problem, traditional flow ability measurements are prone to operator error, have poor repeatability, and, for the most part, are very time-consuming. An automated test and analysis system that takes only minutes, is very repeatable, and is independent of the operator is needed.

The most important innovation required in relation to traditional techniques is a way of classifying powders, so that flow ability performance of each powder can be measured and recorded, along with its processing experience. Eventually, such a database of information could remove much of the uncertainty from processing and provide a reference base for the development of new powders. It would allow each production machine to be classified in terms of the powders that could be processed efficiently.

Ideally, the classification of powders would provide more than just flow ability data, such as flow rate and compaction indices. It would also include data describing the robustness and stability of the powder, for example, vulnerability to segregation, attrition, and vibration. Given this, the two key issues of powder processing could be addressed. First, will the powder flow satisfactorily—does it have flowability properties that suit the process? And second, is the powder robust—will it be adversely affected by being processed?

Freeman Technology and the FT4 Powder Rheometer offer real benefits to all users of powders. These include the following:

- The more efficient use of powder-handling systems by reducing stoppages and optimizing throughput
- Improved product quality by introducing quality conformance checks at all stages of production
- Overall—improved competitiveness

3.5.2 Microscopy

Significant advances have been made in the field of microscopy over the past decade, allowing the study of nanocrystals and elemental analysis using small samples. Some of the spectroscropic and microscopic methods available include the following:

- Energy-dispersive X-ray spectrometry (EDS) for quick and easy elemental analysis of samples in the SEM. It has a minimum detection limit of 0.1% by weight.
- Wavelength-dispersive X-ray spectrometry (WDS) for a more detailed elemental analysis of samples in the SEM. JEOL Four-Crystal Spectrometer attached to the JSM-35C SEM can be used for 1-μm spot analysis, digital and analog line scans, and X-ray image mapping. It provides elements' detection from Be to U and has a minimum detection limit of 0.01% by weight, fully quantitative results are by extended φ–ρ–z.
- Inductively coupled plasma-atomic emission spectroscopy (ICP) provides trace-level and bulk elemental analyses of solid and liquid samples.