COMBINED XRD AND RAMAN COMBINATORIAL SCREENING SYSTEM

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Combinatorial investigations require rapid screening techniques to test and evaluate variations of composition, structure and property within a material library. Unlike most analytical techniques, both X-ray diffraction and Raman spectroscopy are non destructive methods that require virtually no sample preparation, thus, allowing samples to be analyzed simply and quickly in their natural form. These two techniques are also complementary to one another in that X-ray diffraction provides abundant information on the atomic arrangement of the sample revealed through the diffraction pattern and Raman spectroscopy can measure the characteristic vibration frequencies determined by the chemical composition and chemical bond. In addition the optical video image can provide the surface condition, color and shape of the sample. All three measurements (Raman spectrum, X-ray diffraction and optical imaging) can be done in a relative short time. Therefore, a combination of the three functions into one instrument is beneficial to high-throughput combinatorial screening analysis. Combinatorial screening based on spectroscopic and diffraction techniques is of high importance *e. g.* for drug substances and formulations since the polymorphism of active ingredients has to be controlled to achieve a reliable product quality which will satisfy the regulatory authorities.

This presentation covers the development of an innovative instrument consisting of X-ray diffraction and Raman spectroscopy for combinatorial screening. The X-ray source, X-ray optics, X-ray detector, laser source, Raman probe and an auto-zoomed video microscope are all integrated into a single platform so that the X-ray diffraction pattern, Raman spectrum and optical image from the same sample or sample area can be measured simultaneously or sequentially. An X-Y-Z translation stage can bring each cell of the combinatorial library in to both measurement positions. Once the solid-state characterization data are collected and stored, samples can be generally classified into groups or quantified by a novel, statistical, pattern-matching software. Besides fast evaluation of large data bases, convenient access to each individual measurement result *e,g.* the Raman spectrum can be achieved to yield a deeper insight on the molecular level. The software associated with the system can treat data from the various techniques and analyze the results in correlation.