Spectral X-ray tomography for 3D mineral analysis

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Image based analytical tools in geoscience are indispensable for the characterization of minerals but most of them are 2D techniques, limited to the surface of a polished plane in a sample. X-ray micro computed tomography (micro-CT) is becoming a common analysis technique in geoscience and provides direct 3D information of the internal structure of a sample. A major drawback of micro-CT in the characterization of minerals, however, is the lack of chemical information. There have been different approaches to obtain chemical data using micro-CT but most of them are time consuming and difficult to adapt to regular use.

Therefore we introduce a potential new analytical tool: Laboratory-based Spectral X-ray Micro Computed Tomography (Sp-CT). Results from a spectral imaging detector prototype, installed inside a TESCAN CoreTOM micro-CT scanner, will be shown. This new analytical technique enables to obtain both high resolution structural and chemical information in 3D. With this information, the mineral distribution inside unbroken rocks and particles can be identified and quantified.

Based on the transmitted energy spectrum of a sample, main elements can be distinguished and minerals classified. It is also possible to quantify heavy elements within particles of complex composition and the measured sample volume is significantly larger compared to conventional analytical 2D techniques. Furthermore, Sp-CT is non-destructive and does not require sample preparation.

Sp-CT will open exciting new possibilities for mineral analysis. With this new technique, the 3D properties of the particles can now be measured and used for example in process mineralogy simulations. This is a major improvement to current simulations that predominantly use less representative 2D or bulk particle properties. Moreover, the Sp-CT could potentially be used as an alternative technique for regular characterization of ore deposits and processed ores since more representative volumes can be analyzed in a fast manner relative to existing techniques.

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