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3D imaging at the Unisa-Mintek X-ray microscopy facility

Content

Over the last decade, advances in X-ray computed tomography (XCT) have resulted in the extraction of important 3D data in the geo- and materials sciences. In South Africa, the establishment of three national centres for XCT has seen many researchers exposed to the technique for various applications. The Unisa-Mintek facility was recently established to add to 3D imaging capabilities in the country, using a Zeiss Versa 3D X-ray microscopy (XRM) system.

The system affords high resolution scanning (to 0.7 μm spatial resolution) of mm-to-cm-scale diameter samples, using a combination of geometric and optical magnification, and is therefore not limited by the focal spot size, as in conventional XCT. Furthermore, the configuration and detector system are optimised to allow enhanced phase contrast, particularly for low atomic number materials.

The XRM image attributes are of particular importance for grey-level phase distinction in mineralogy, geosciences, and materials science applications. The high resolution and phase contrast allow for the distinction of fine-grained phases in multi-component samples, in such applications as process mineralogy, for the identification of micron-sized minerals of economic importance. Additional resources for 2D-3D comparison and calibration methods are provided by Mintek, viz., automated scanning electron microscopy and micro-X-ray fluorescence imaging, as complementary techniques to the 3D X-ray microscopy. An image registration protocol has also been developed to facilitate 2D-3D comparison in assigning grey levels to appropriate minerals/phases in samples. This talk will examine different applications in illustrating the capabilities of the system, with a focus on mineralogy.

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