Confocal X-Ray Fluorescence Microscopy study on plant roots using synchrotron source

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Abstract

X-ray fluorescence (XRF) is a powerful technique for elemental analysis in part owing to its minimal sample preparation requirements and sub-ppm-sensitivity. However, conventional XRF imaging generally requires thin samples, which is not always desirable or possible, e.g. for brittle samples or when non-destructive analysis is required. Non-destructive 3-D confocal XRF microscopy allows spatial discrimination of XRF photons in all three dimensions and enables high resolution x-ray spectroscopy, such as XANES, to be performed directly on a small region of interest within large samples. Polycapillaries are the most common collection optics used for a confocal XRF microscopy, but limit the technique to depth resolution of upwards of 10 µm at 10keV. The new confocal XRF microscopy capability at sector 20-ID, enabled by CHESS micro-channel arrays (CCA), [1] are capable of achieving depth resolution of 2 - 5 µm. CCAs provide both an improvement in resolution and, in addition, invariant spatial resolution with the x-ray fluorescence energy. We will present detailed current capabilities of the confocal technique at Sector 20-ID and show how we utilized the technique to understand the transport of metals in plant roots.

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References

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