

## From data to information with selective BSE contrast methods of TESCAN's CLARA Field-Free UHR-SEM

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### Abstract

With the ongoing consolidation of UHR-SEM resolution performance, the evaluation criteria for UHR-SEM capabilities is slowly but surely placing more emphasis on the ability to use a wide diversity of contrast methods to reveal information that is not visible with resolution alone.

In general, when energy is transferred to the specimen by the primary beam, the sample generates a range of useful signals that are exploited to characterize the material. One of the principal signals generated by the sample, the backscattered electron signal (BSE), originates from different depths below the surface of the sample, at a range of angles, and emitted energies. BSEs captured at different angles from the sample surface contribute differently to the imaging of sample morphology (shadowing) and potentially to grain orientation (channeling contrast). Low-energy loss BSEs reveal more surface detail than high-energy loss BSEs do. Thus, angular and energy-selectivity of the BSE signal are considered secondary backscattered electron contrast methods, additional to the primary method to image phases by different shades of grey. It is evident that having the ability to acquire the BSE signal selectively can potentially enhance the information that a backscattered electron image reveals.

TESCAN CLARA UHR-SEM is tackling this requirement by implementing a comprehensive choice of backscattered electron detectors, including chamber-mounted segmented solid-state or scintillator backscattered electron detectors, an on-axis in-column detector, and the proprietary in-column Multidetector™. The Multidetector™ offers users the unique ability to discern signals by the energy of incoming BSEs and collect BSE contrast from the very surface of the sample.

The Multidetector™ is included in any TESCAN CLARA UHR-SEM base unit, which makes TESCAN CLARA a desirable tool for the curious Material Scientists that wish to explore their samples with the widest possible range of contrast methods to yield that piece of critical information that they seek.

**Keywords:** SEM, BSE, UHR SE, Electron contrast, Contrast methods, Energy filtering