Novel applications of iLEM for material science

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The relatively new field of integrated light and electron microscopy (iLEM) [1] allows electron micrographs to be correlated with optical ones; electron micrographs typically highly resolved structural information [2] whilst optical images, in particular when fluorescence, is ideally suited to retrieve information on dynamic molecular processes occurring within the sample [3]. Established commercial correlative light and electron microscopy (CLEM) systems employ a consecutive optical and electron microscopy imaging and fiducial markers allow to align separate images. The system at KU Leuven allows simultaneous optical and electron microscopy as it is built around the SECOM platform of Delmic (Delft, The Netherlands), and especially this iLEM system combines a widefield fluorescence microscope with single molecule sensitivity inside the chamber of an environmental SEM. This iLEM approach has several advantages over the shuttle type: Firstly it is possible to collect electron and optical images simultaneously, this can be used to accurately correlate the two channels together and reveals how an electron beam affects the sample luminesce, secondly it also allows both electron and optical images to be dynamically acquired which is particularly suited to observing how physical changes in the sample affect the photoluminescence and vice versa.

We present some novel applications of this advantage, illustrating the technique’s usefulness for material science applications. For example, etching nanorods affects the wavelength and intensity of photoluminescence, [4] it is possible for this process to be imaged in situ obtaining both electron and optical images. It is also possible to obtain a series of electron images of Ag dendritic growth on ZnO particles that have been induced by UV exposure [5]. These examples begin to show the potential of the instrument for material science applications.