Micro X-ray fluorescence (MXRF) offers powerful capabilities in elemental imaging. Areas as small as several hundred micrometers to tens of centimeters can be scanned to produce elemental images. These qualitative elemental images can clearly identify areas of heterogeneity, give relative distributions of the elements and highlight areas of interest for higher resolution probes. However, the major drawback of all MXRF based mapping is the resulting elemental images can only be correlated to other elements visually. In most cases this is simply achieved by visually inspecting the different elemental images and trying to correlate the elemental maps by eye. Generally this is not difficult when the composition consists of only a few elements. However, when the elemental composition increases to five or more elements, visual correlation of the individual elemental images can be difficult at best. The major concern is a critical elemental correlation can be overlooked if an element was not identified in the initial scan, or the elemental correlation is subtle or insufficient distinct registration of the separate elemental images effectively conceals any correlations.

A new software program developed by Sandia that automatically analyses X-ray spectra from electron excitation on an SEM has been applied to X-ray tube excited spectra. This software is based on multivariate curve resolution (MCR) and utilizes the full spectrum at each pixel. The advantage of this approach over the region-of-interest mapping is that it allows for full utilization of the spectral components. Therefore no elements can be missed, and the MCR approach automatically performs the correlation. The result is not only elemental images, but also elemental phases or chemical phases based on elemental composition. This then removes the subjective nature of the visual correlation and enables the visualization of both major and subtle elemental correlations.

Several examples of this integration of the Sandia program with MXRF spectra will be presented. These applications will highlight the ability to acquire and produce chemical images for a variety of materials.