Spectrum imaging: microanalysis for a new millennium

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Spectrum imaging – where a full spectrum is acquired at each pixel in a two-dimensional array – will become a routine microanalytical tool as we enter the new millennium. With suitably chosen acquisition parameters, a spectrum image can provide chemical mapping of a microstructure in a comprehensive fashion. However, spectrum images are typically large raw data files: tens of megabytes today and potentially gigabytes in the near future. In order to fully access the advantages of spectrum-imaging, effective "data mining" methods must be developed to extract the relevant information – typically a fraction of a megabyte – from these large raw data files. During the past few years, spectrum imaging capabilities have become commercially available from a number of manufacturers, each providing an array of tools for extracting information from the analyzed specimen. These tools typically involve a user-selected region of interest comprising a series of channels or pixels from which a representative intensity map or spectrum can be constructed. More complex tools for the analysis of spectrum images, which require no a priori input from the user, are being explored at a number of research laboratories. These tools have the advantages that they are robust, identifying all distinct components of the spectrum image – not just those thought to be there – and they are suitable for automated data analysis. This talk seeks to outline the current state and future potential of spectrum imaging methods, with illustrations from a number of materials science applications. The basics of spectrum imaging will be overviewed and highlighted with results obtained with a commercially available spectrum imaging system. Advanced methods of spectrum image analysis will be discussed and illustrated by applications of linear multivariate statistical analysis methods that have been developed by the speaker at Oak Ridge National Laboratory. Applications will include the analysis of a variety of metal, ceramic, semiconductor and polymer specimens by a number microanalytical techniques.

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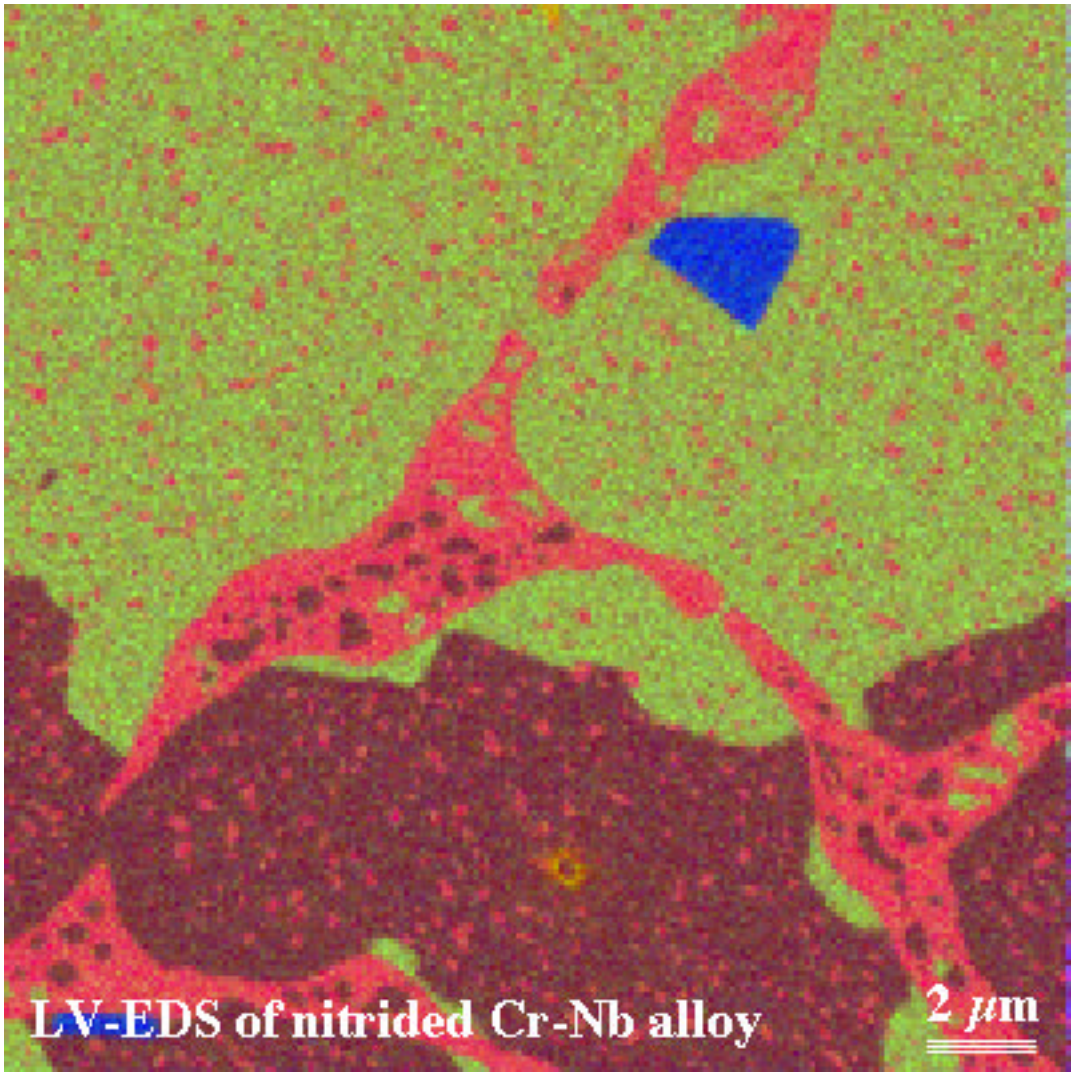
LV-EDS of nitrided Cr-Nb alloy
2 μm