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Procedure for EDX analysis

A detailed step by step procedure of the EDX analysis using a real example (GaP₁₋₀.₆₅As₀.₃₅ alloy) is given below. Igor Pro was used as the programming software to write the code of the EDX analysis.

1. **Information**: Prior to performing the composition analysis the following information are gathered:
   a. Reference EDX spectra (.txt format), beam current (in nA), lifetime (in sec) and elemental composition (x and y) of all the standards to be used. In this case GaAs and GaP were used as standards (spectra shown in Fig 4) where x = 1, y = 1 for both.
   b. Thickness of at least one reference standard (in this case GaAs = 50 nm)
   c. EDX spectra (.txt format), beam current (in nA), lifetime (in sec) from the test specimen (GaP₁₋₀.₆₅As₀.₃₅ alloy)
2. Enter all the information (inputs)

   a. Reference spectra in the table labeled “reference_spectra” (upper left corner of Image 1)

   b. Elemental composition in the table labeled “known_composition” (center of image 1)

   c. Parameters such as beam current under “Devect” and lifetime under “tAcqVect”. Note: you can enter as many numbers as needed in the “parameters” table (lower right corner of Image 1). Other parameters under “params” column are absorption (0 or 1), number of iteration and the detector take-off angle alpha (deg).

   d. Enter thickness of at least one standard in “standard measurement” table under “TstdVect”. (GaAs = 50 nm thick)

   e. Input all the references in “reference measurements” table (upper right corner of Image 1). Here we refer all the parameters which will be used and are related to reference spectra.

Image 1: Parameters provided as inputs to the software
3. **Solve PCA zeta factor:** Under macros drop down menu hit Solve PCA Zeta Factors (Ctrl+1). After completing the iterations the summary of results is displayed in the Igor pro command prompt. The “reference_compositions” were calculated and displayed (bottom center of image 2). Note that the calculated compositions match well with the known compositions entered into the “known_composition” window. The software also calculates the relative thickness of all the other standard spectra under “TVect” column in the “reference_measurements” window (upper right corner of Image 2).

![Image 2: Solving PCA zeta factors](image)

Complete Summary of results after solving PCA is displayed in command prompt window labeled EDX_PCA_zeta_GaAsP -1 as shown in Image 3.
4. Enter experimental EDX spectra from test specimen: The spectrum of the test specimen was uploaded under “IVect” column of the “analysis” table (upper half of image 3). Under “macros” drop down menu “find composition” is chosen. The results are displayed in the analysis table. “WpVect” shows the elemental compositions of the test specimen, and “dWpVect” shows the errors. The foil thickness T is displayed under the “aParams” table. The complete summary of the results (with errors) are displayed in the command prompt window of Igor Pro.
This method also allows you to generate EDX spectra for any arbitrary composition as shown in the graph (Image 5) below. Red graph is the experimental spectra and blue is the spectra generated from the software for a GaP_{1-x}As_x sample.
Note: The igor pro code for the above analysis is available on request. Please feel free to email at

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