

## Comparing approaches to helium quantification by EELS

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The main problem when quantifying the amount of helium in a bubble using EELS is the strong signal exhibited by most solids over the range 21-25 eV in which the helium K excitation occurs. One must extract the He signal from this background. We will compare several approaches, namely spatial difference, curve fitting and the multivariate analysis (MVA) approach known as independent components analysis (ICA).

ICA aims to separate signal mixtures into their independent sources. It can be viewed as an extension to the better-known principal components analysis (PCA). A non-trivial problem is knowing where to cut off the data (how many components to retain). The helium signal has not yet successfully been completely isolated from the bulk signal.

The curve-fitting approach gives He densities in line with those found in similar previous work (up to 100 at.nm<sup>-3</sup>). ICA appears systematically to yield lower values (but still in the typical range). Genuine signal information is probably being lost in the PCA/ICA process. Small thickness variations can lead to non-linear features in the data due to multiple energy losses. Deconvolution has thus far proved ineffective in completely eliminating these effects and introduces noise problems of its own. Various other multivariate approaches are currently under investigation as an alternative to ICA (see presentation).