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The use of Au and Pt x-ray N lines for correct EDX analysis of C in gold and platinum depositions of micro and nano structures

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Abstract:
One technique to create small Pt and Au nano scale direct structures is Electron Beam Induced Deposition (EBID). These structures however, often suffer from included carbon, as the related precursor often is an organo metallic chemical substance. Research programs focus on optimizing the EBID process to minimize the carbon content of the deposition. A fast and good in-situ method to determine the amount of carbon, is low kV EDX. However, in existing systems the x-ray N lines of Au and Pt can be completely ignored because their lines are not included in the library of x-ray lines, and as their energies are close to the carbon K alpha energy they fall within the typical energy resolution width of the detector (~ 40 eV at C K) and hence are accounted for as originating from carbon. As a consequence substantial errors are introduced. Especially in nano technology and thin film applications, low kV excitation is a must and as a consequence the x-ray N lines of these metals cannot be ignored. This is not common practice in existing commercial EDAX systems while x-ray N line lines are not reported in for example the NIST database. Their energies but not their intensities were found in [1]. To correct the situation, the excitation ratio of the M multiplet and N doublet lines has been determined as a function of the applied kV for both Pt and Au> with this measurement using pure standards, correction factors for the carbon net intensities have been determined. They are applied, to manually correct the net intensity of the carbon K alpha line and hence the amount of carbon (%AT) in relation to the amount of Au and Pt. Especially in the regime where the purity of the EBID starts to be good (above 70 – 80 %AT), this correction is essential. In this way the research for purity developments of EBID based structures is improved and EDX can be applied correctly.

[1] X-ray Emission and Absorption Edge Wavelength and Intensity Setting for LiF Geared Curved Crystal Spectrometer, E.W. White, G.G. Johnson, Pennsylvania State University 1979,