LoMaX Spectral Artifacts

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Wavelength dispersive spectroscopy (WDS) using the HexLEXS differs from traditional curved crystal WDS in that it utilizes collimating optics to collect a large total effective solid angle of X-ray flux which is subsequently wavelength dispersed by diffraction from flat crystals and multilayers. Secondary X-rays fluoresced in the HexLEXS collimating optic emerge uncollimated, and thus contribute to an increased X-ray background-- not as spurious WDS peaks. This is also true for secondary X-rays produced by fluorescence within the diffracting crystals and multilayers themselves. In the case of the LoMaX, a reflective optic is used in conjunction with a EDS detector, so any X-rays produced by fluorescence within the LoMaX optic will arise as spectral artifacts.

Figure 1. LoMaX Spectral Artifacts: C with 1nA @ 10kV

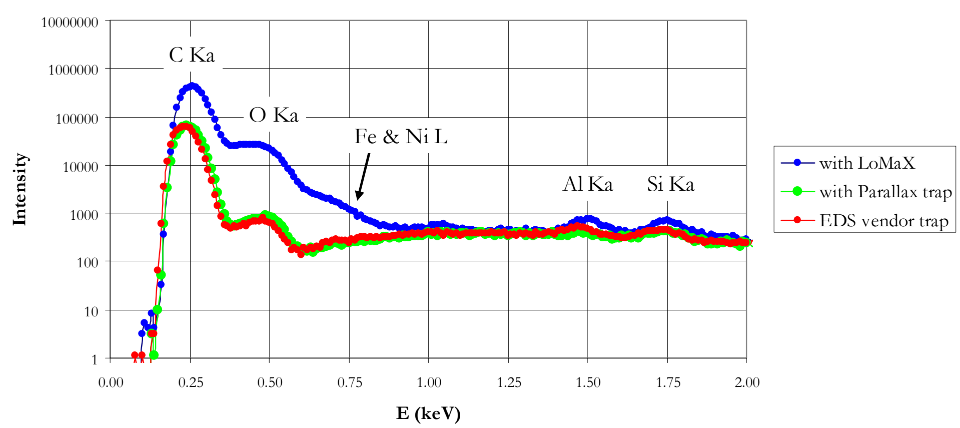


Figure 1 shows data was taken on C with 1nA @ 10kV using the LoMaX with a commercial EDS system, as well as with both the Parallax Research, Inc., electron trap and that of the EDS system vendor. In the region below 1kV where the LoMaX has a non-unity gain, only a very small artifact due to the Fe and Ni L lines is visible. As this is seen only with the LoMaX it is assumed to be due to fluorescence within the optic and its housing. The Al and Si K_α artifacts are seen both with and without the LoMaX and are attributed to secondary fluorescence in the SEM chamber (*e.g.* Al) or within the EDS detector itself (*e.g.* Si). This data also demonstrates the efficacy of the Parallax Research, Inc., electron trap.

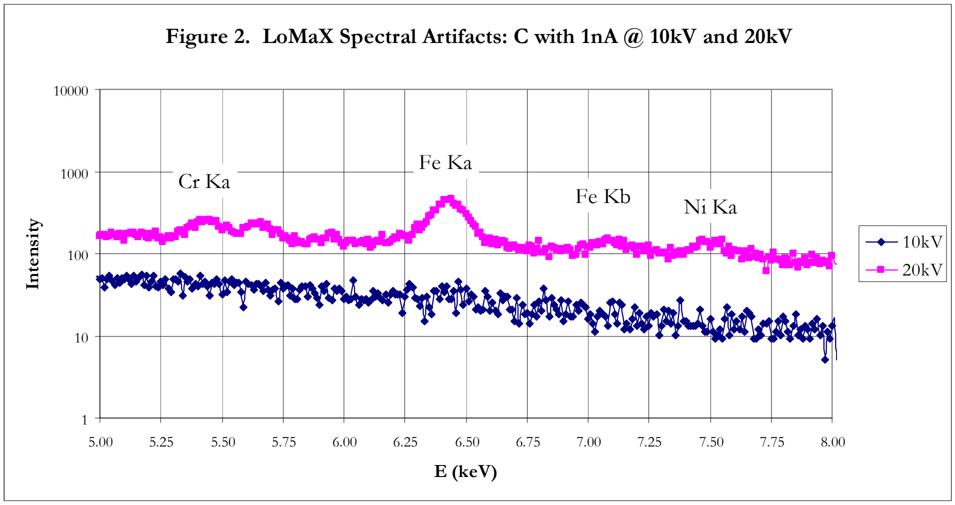
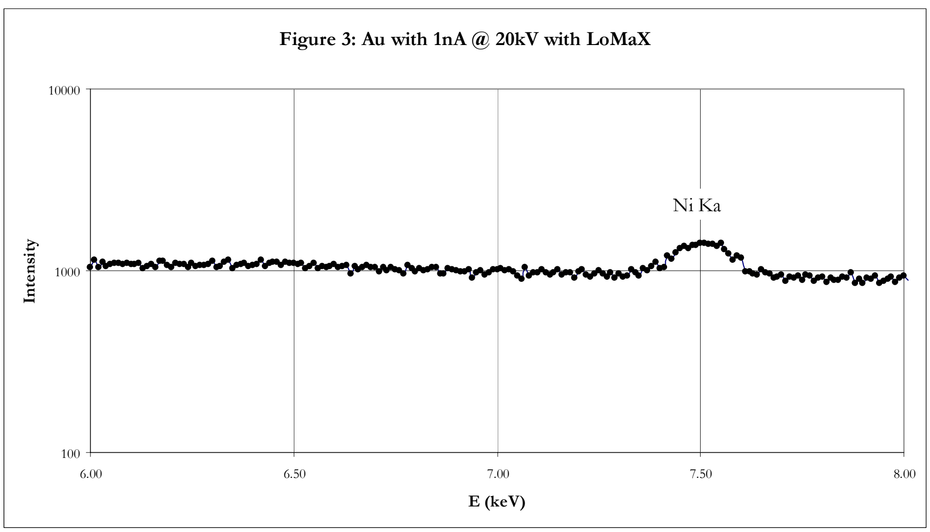


Figure 2 above shows the X-ray K-line region for data taken with 1nA on C at 10kV and 20kV. The 10kV data shows no spectral artifacts, while the 20kV data shows more Cr K_α and Fe K_α than Ni K_α. EDS analysis of the LoMaX optic material itself shows no Cr or Fe, indicating that most of this spectral contamination is likely due to secondary X-ray fluorescence from steel components within the SEM chamber. Thus, for low energy applications with beam energies below 10kV, where the LoMaX has its greatest utility, minimal spectral contamination is expected even at higher energies due to the low efficiency for fluorescence.



To study the effect of X-ray fluorescence within the LoMaX optic, data was taken with 1nA at 20kV on gold. While the Au L and M lines, like the C K line, are too low in energy to fluoresce the Ni Ka line, the Au specimen produces significant higher energy Bremstrahlung capable of such fluorescence. *Figure 3* above shows the definite signature of fluoresced spectral contamination. However, at high incident beam energies and X-ray energies, the LoMaX would likely be removed for most applications since it does not provide any gain above 1keV.