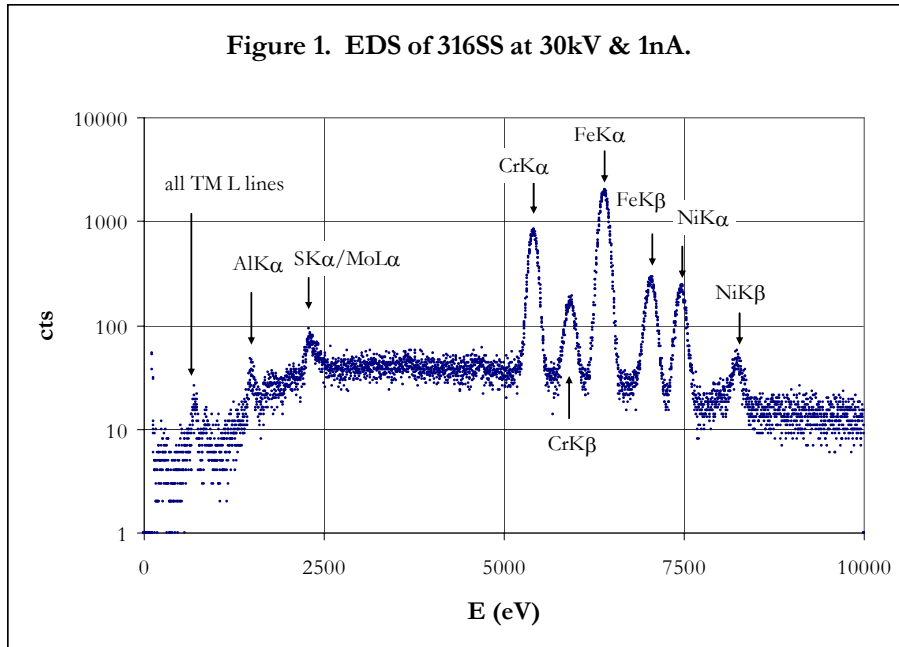


The HexLEXS L-Line Advantage

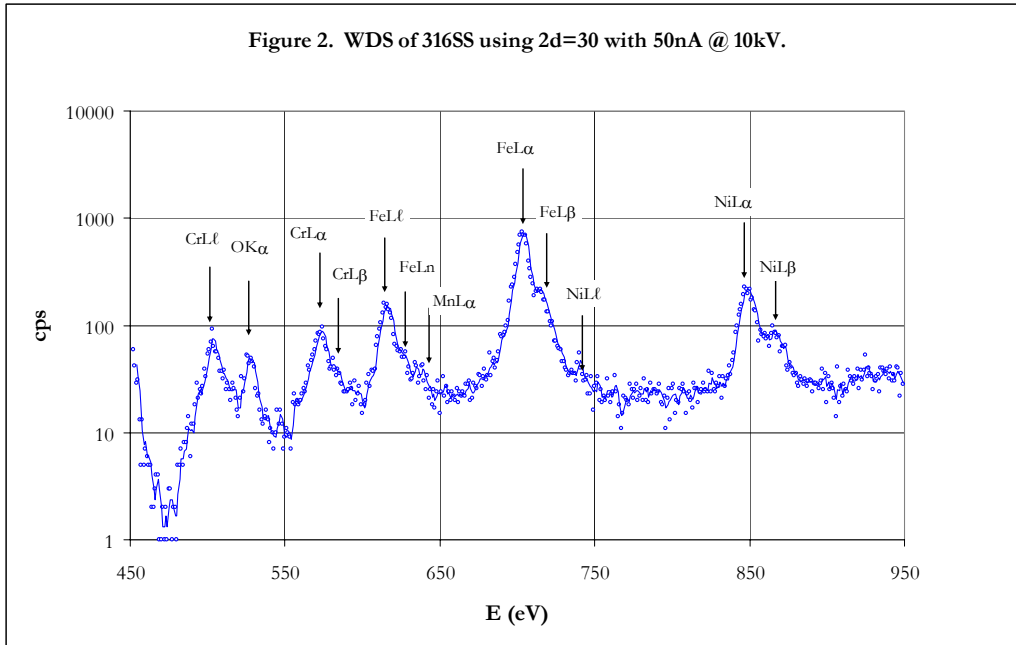
Parallax Research, Inc.
Box 12212, Tallahassee, FL 32317
phone: 850-580-5481 • fax: 850-668-4133
www.parallax-x-ray.com • prlax@mindspring.com

The poor energy resolution of EDS (~ 150 eV) makes the study of transition metal K lines central to the spectroscopic examination of many metal and metal alloy systems. Even then the K_{α} and K_{β} peaks of neighboring transition metals ($\Delta Z = \pm 1$) often overlap, requiring deconvolution for analysis. The assay of stainless steels is a classic example, as it contains four neighboring transition metals—Cr, Mn, Fe and Ni—with Mn present as a trace element. *Figure 1* below shows EDS data taken at 30kV on 316 stainless steel. Evidence of Mn is obscured as the Mn K_{α} is unresolvable from the Cr K_{β} . Also of interest is the inability to resolve SK_{α} from MoL_{α} . Additionally, all of the transition metal L lines are unresolvable from each other or from the OK_{α} , and 50% of the spectrum obtained is featureless background.



The HexLEXS allows a complete analysis of this 316 sample with much higher energy resolution using entirely L-lines. The use of L lines for analysis allows for much smaller electron beam energies. Smaller beam energies can be used to constrain the analysis volume within a thin-film layer or within a defect structure. While the EDS data in *Figure 1* took 300 seconds, the HexLEXS WDS data in *Figure 2* took 450 seconds. The ~ 8 eV resolution of the HexLEXS using $2d = 30$ allows resolution of the transition metal ℓ and n lines, and allows for the resolution of the O K_{α} line from the transition metal L-lines. The presence of ~ 2 %wt of Mn is clearly detectable by the Mn L_{α} line between the Fe L_{ℓ} and Fe L_{α} lines.

While the HexLEXS data was taken at a significantly higher probe current, 50nA is well within the capacity of modern SEM's—even at lower electron beam energies.



If detection of trace such elements as Mn is not of concern in the assay of the 316SS or related material, higher throughput can be obtained from the 2d = 60 diffractor at the expense of resolution. *Figure 3* shows HexLEXS WDS data taken on 316SS at 10kV @ 50nA using 2d = 60. While the trace element Mn is not detectable and L_α-L_β pairs are not resolvable, such data is suitable to quantitate Cr, Fe and Ni using L lines to subsequently differentiate 316SS from 304SS.

