EDXRF ANALYSIS OF $Cu(In,Ga)(S,Se)_2$ PHOTOVOLTAIC FILMS (THE S-Mo CONUNDRUM)

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Interest in Thin-Film Photovoltaic (TFPV) continues to grow as an alternative to more established Si wafer based Photovoltaic (PV) cell. This has been driven by the lower manufacturing cost of TFPVs and versatility of their applications, for instance, integration into building materials. A lot of development effort and now manufacturing effort have been invested in chalcopyrite films, in particular $Cu(In_xGa_{1-x})Se_2$ (CIGS). Critical to development and manufacturing of CIGS based solar cells is control of the alloy composition. X-ray Fluorescence has played an important role in the compositional characterization of CIGS films and is becoming an increasingly more important in-process tool as CIGS solar cell development moves into full scale manufacturing.

To increase cell efficiency (conversion of light photons to electricity), a number of CIGS cell developers are adding Sulfur to their CIGS chemistry – CIGSSe, which increases accessible band gap and lattice constant range. Typical CIGS and CIGSSe systems utilize a film of Mo as the back contact for the cell. So, the stack presentation for XRF analysis is CIGSSe / Mo / Substrate, which of course, presents the classic Mo L series – S K series conundrum for EDS spectrometers.

With greatly improved peak resolution from Silicon Drift Detectors and improved peak fitting routines the S K – Mo L spectra can be accurately deconvoluted. This paper demonstrates and discusses the analysis of CIGSSe / Mo / Substrate with an EDXRF spectrometer and accurate deconvolution of the S – Mo overlap that this necessitates.

The primary requirement for XRF in TFPV is in production, not the lab. The paper also discusses optimizing spectrometer parameters for the high throughput demands of in-line and in-situ instrumentation.