Application of X-ray photoelectron and Auger Electron Spectroscopies in Hydrometallurgical Processing

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The application of X-ray photoelectron and Auger Electron Spectroscopies (XPS & AES respectively) in hydrometallurgical processing are complicated in many instances by post sampling reactions and the utilization of inappropriate reference material for data analysis. The purpose of this presentation is to bring forward several XPS-AES sampling and data analysis methodologies that have been developed and utilized to study mineral losses in sulphide flotation plants, gold leaching from sulphide ores and sphalerite leaching ferric sulphate-sulphuric acid media.

To obtain a detailed understanding of mineral solution interactions it is essential that the chemistry on the surface of the mineral be preserved from the time of sampling until the time of analysis. For laboratory based experiments conducted in close proximity to instrumentation the time lapse could be only a few minutes, while for samples from operating hydrometallurgical processing plants the time interval can be more than a month. To address this issue, a sampling protocol utilizing gas purging, cryogenic storage, selective filtering, vacuum drying and vacuum transfer is presented and discussed.

The processing and interpretation of XPS-AES data require some knowledge of the chemical makeup of the solids as well as the solution in the hydrometallurgical processing system under consideration. XPS-AES data analysis methods that utilize XRD powder diffraction, reference spectra collected from fresh sulphide mineral surfaces and reference spectra sets from processing streams in flotation plants are presented and discussed.