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(G*) Zinc and Cadmium: XPS Chemical State Determination Using Auger Parameters and Auger Peak Curve-Fitting Procedures

Monday 27 May 2024 16:30 (15 minutes)

Zinc and cadmium compounds are indispensable to critical sectors such as corrosion control, energy, and manufacturing. In applications ranging from coatings to battery electrodes and photovoltaic devices, the ability to precisely characterize different zinc and cadmium compounds is essential. This ability aids our understanding of changes in surface chemistry, surface mechanics, and material properties. X-ray photoelectron spectroscopy (XPS) has been repeatedly demonstrated as a powerful analytical tool to achieve such speciation, provided there is sufficient quality reference data available. Typically, speciation is achieved by analyzing shifts in photoelectron binding energies, and occasionally, Auger electron kinetic energies. Due to overlapping main photoelectron binding energies in many zinc and cadmium compounds, Auger electrons and the modified Auger parameter are also crucial for reliably detecting changes in chemical state. Despite zinc and cadmium's prevalence in surface applications, there is a notable scarcity of high-quality XPS reference data for these compounds beyond the metals and oxides. The available data often lacks the breadth and reliability required for precise chemical state analyses, with inconsistencies, uncertainties, and issues of reproducibility. Existing literature also frequently overlooks Auger signals and Auger parameters, despite their proven utility.

In this presentation, recent work to extend upon previously published XPS data and curve-fitting procedures will be detailed for a wide range of high-purity zinc- and cadmium-containing compounds. This will include a summary of current literature data, with careful exclusion of any sources that contain issues related to reliability. A summary of novel XPS data collected for forty unique zinc and cadmium materials including photoelectron binding energies, Auger kinetic energies, Auger parameters, and counterion binding energies will also be highlighted. Lastly, the applicability of curve-fitting Auger signals to analyze unknown mixed-species systems that contain zinc or cadmium will also be showcased.

Keyword-1

XPS

Keyword-2

Auger peak-fitting

Keyword-3

speciation

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