

XRF Sensitivity Improvement with a Novel Capacitive Concentration Cell

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[session: New Developments in XRD & XRF Instrumentation]

A novel preconcentration method is presented in conjunction with experimental results obtained using turn-key XRF hardware currently in development along with data obtained using off-the-shelf handheld XRF instruments. Dissolved metals in a liquid sample are concentrated within a sample cell in a reversible capacitive deionization process using extremely high surface area ($>300 \text{ m}^2/\text{g}$) mesoporous carbon electrodes. Experimental data have shown that the method is applicable to a wide range of elements; however the increase in sensitivity does appear to be element-specific, with effective Limits of Detection ranging from approximately 10 ppb to low ppm levels. This wide range is due in part to different electrochemical properties of the various elements of interest and due to the attenuation of emitted low energy photons by a thin layer of water within the sample cell. Upon investigation, it is evident that low energy/light element sensitivity can be enhanced by evacuating the cell prior to XRF analysis, as collected ions remain in place on the electrodes even after the liquid matrix is removed.