

Rotating Sample System: A simple equivalent of a Rotating Disk Electrode for detection of trace Pb in microliter samples

Conventional and current methods to evaluate trace metals contents in aqueous samples include Atomic Absorption Spectrometry (AAS) and Inductively Coupled Plasma Mass Spectroscopy (ICPMS). The corresponding instrumentation is expensive, bulky and a high level of expertise is needed for operation. We propose to use the Rotating Sample System (RSS) as an alternative approach to trace metal analysis. The RSS is a simple equivalent of the Rotating Disk Electrode, which is commonly used for electrochemical analysis. The RSS consists of a 20 microliter sample drop which is rotated to generate convection using humidified air jets. The sample is placed on a flat, stationary substrate containing the working electrode. Diffusion to and from the electrode is limited only by a diffusion layer that can be as thin as 4 micrometers, due to the rapid rotation of the drop. This leads to, in a relative sense very high, electrochemical fluxes and thus, currents, even when the analyte is present at a very low concentration. The stationary substrate with the electrode may be micro-fabricated with standard technology and thus, made disposable. We will report optimization studies of the system parameters such as electrode size and position, as well as deposition time, and results of detection of Pb in the 2-10 parts-per-billion range. Real useable sensitivity of the system extends into the parts-per-trillion range.