

Abstract

The identities of unknown analytes within four eutectic LiCl-KCl melts were determined using electrochemical methods, simulating the uncertainty of electrochemically probing an electrorefiner salt bath or molten salt nuclear reactor. With a variety of electrochemical methods (e.g. cyclic voltammetry, chronopotentiometry, and square-wave voltammetry), and electroanalytical techniques (e.g. semi-differentiation), every analyte was positively identified, although one false positive occurred because of an unexpected chemical interaction. This study highlights some remaining challenges for the use of electrochemical sensors in nuclear material control and accountability in molten salts: (1) quantification of analytes without the use of calibration curves (e.g. error in property values, such as diffusion coefficient) and (2) additional and interfering electrochemical signals due to interaction and alloying of multiple species.