Low-Level Actinide Glasses for Spatial Analyses

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The application of a variety of spatially resolved measurement methods for quantifying low concentrations of actinides require materials appropriate for calibration and comparison between analytical approaches. Studies of vitreous materials including actinide mobility in vitrified waste glasses, trace element distributions in tekties, and actinide diffusion glassy fallout are among current topics of interest. While many analytical methods require working reference materials well-characterized for uranium concentration and isotopic composition, homogenous at a spatial level appropriate to the application, and representative of the materials of interest as the basis for assessing accuracy and precision, few if any appropriate standards exist for these purposes (Leggit *et al.*, 2009; Inn *et al.*, 2013). Here, we present a series of uranium-doped silicate glasses were created for application as working reference material analogs for low uranium concentration research.

The aim of this effort was the generation of a suite of glasses spanning a range of uranium concentrations and isotope compositions, and of sufficient homogeneity for spatially resolved instrumentation research and development purposes including Secondary Ion Mass Spectrometry (SIMS and NanoSIMS), laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS), Resonance Ionization Mass Spectrometry (RIMS), and SIMS-Single-Stage Accelerator Mass Spectrometry (SIMS-SSAMS). Two calcium-aluminum silicate base glasses were utilized to produce a set of six U-doped glasses, with a targeted variance in ^{235}U content from ~0.725% (natural uranium), ~50%, and ~93%, across three U concentrations from ~5, ~50, and ~500 ppm. We present initial results from the characterization of these materials by multiple analytical approaches. While the glasses produced here are not intended to replace or become formalized standard materials for uranium concentration or uranium isotopic composition, it is hoped that they will help fill a current gap, providing low-level uranium glasses sufficient for methods development and method comparisons.