Abstract Submitted
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Global Modeling of Uranium Molecular Species Formation Using Laser-Ablated Plasmas[1] DAVIDE CURRELI, MIKHAIL FINKO, University of Illinois at Urbana Champaign, Urbana, IL 61801, MAGDI AZER, Illinois Applied Research Institute, Champaign, IL 61820, MIKE ARMSTRONG, JONATHAN CROWHURST, HARRY RADOUSKY, TIMOTHY ROSE, ELISSAIOS STAVROU, DAVID WEISZ, JOSEPH ZAUG, Lawrence Livermore National Laboratory, Livermore, CA 94550 — Uranium is chemically fractionated from other refractory elements in post-detonation nuclear debris but the mechanism is poorly understood. Fractionation alters the chemistry of the nuclear debris so that it no longer reflects the chemistry of the source weapon. The conditions of a condensing fireball can be simulated by a low-temperature plasma formed by vaporizing a uranium sample via laser heating. We have developed a global plasma kinetic model in order to model the chemical evolution of U/UOx species within an ablated plasma plume. The model allows to track the time evolution of the density and energy of an uranium plasma plume moving through an oxygen atmosphere of given fugacity, as well as other relevant quantities such as average electron and gas temperature. Comparison of model predictions with absorption spectroscopy of uranium-ablated plasmas provide preliminary insights on the key chemical species and evolution pathways involved during the fractionation process.

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