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Development of Waste Forms for Radioactive Iodine

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Radioactive iodine-129 is present at low concentrations in spent nuclear fuel and is of particular concern due to its extremely long half-life and its effects on human health. In spent fuel reprocessing schemes, the iodine is typically released in gaseous form and collected using Ag-loaded zeolites. We have investigated several possible processes for producing a stable waste form from these iodine-containing Ag-zeolites. We have investigated the stability of iodine-containing zeolites using thermal analysis and electron microscopy, and determined the effects of treatments such as reduction and exposure to formates. We found that direct conversion of the zeolites to more stable ceramic forms requires heating to temperatures where iodine volatilization (from AgI) is significant. Therefore, we have explored encapsulation of the zeolites in low-sintering (<500˚C) bismuth oxide-containing glasses. The durability and microstructure of these materials will be discussed. In conclusion, we found that formate-treated iodated Ag-zeolites can be encapsulated in these glasses without loss of iodine during processing. This work was performed at Sandia National Laboratories, Albuquerque, NM. Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Safety Administration under Contract DE-AC04-94AL85000.