

CERMET TRANSPORT, STORAGE AND WASTE PACKAGES USING DEPLETED URANIUM DIOXIDE AND STEEL

Charles W. Forsberg and Larry B. Shappert

Oak Ridge National Laboratory*
P.O. Box 2008
Oak Ridge, Tennessee 37831-6179
Tel: (865) 574-6783
Fax: (865) 574-9512
Email: forsbergcw@ornl.gov

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Summary

Depleted uranium (DU) dioxide (DUO_2)–steel cermet are proposed for constructing storage, transport, and disposal packages for spent nuclear fuel (SNF) and other applications. These cermets are fabricated from DUO_2 mixed with steel (which forms the continuous phase) and are clad between two clean, steel layers.

DUO_2 cermets have several advantages as compared to steel and other materials used for waste package (WP) construction: greater density than steel, tougher than most metals, beneficial use of DU, and assured long-term nuclear criticality control. The components of the cermet (DUO_2 and steel) are chemically compatible with repository applications. Unlike uranium metal, cermets are more chemically inert and thus avoid uranium-metal issues.

This paper will discuss the use of cermets to make baskets and packages used for storage, transport, and disposal of (1) SNF in Yucca Mountain and (2) ^{233}U in the Waste Isolation Pilot Plant. In each case, potential long-term repository criticality concerns exist because of the fissile content of these wastes. If the packages and baskets contain DU, the DU oxides will (1) mix with the fissile uranium when the WP degrades after repository closure and (2) minimize the potential for nuclear criticality. The cermet conforms with the Nuclear Regulatory Commission preference for uranium oxides (versus other forms) in repositories. Other potential benefits include shielding, modifying the environment to reduce radionuclide releases, etc. Many wastes would be packaged at production sites; consequently, the basket and package structures must meet storage, transport, and disposal requirements. There are other transport and package applications where other DUO_2 cermet characteristics (shielding, strength, etc.) may make them useful for packages. These will also be discussed.

Nonnuclear cermets have low production costs when manufactured on a large scale. UO_2 cermets have been manufactured—but only in limited quantities as nuclear fuels. Studies are underway to better understand the economics. Cermets are expected to be less expensive to manufacture than DU metal because DUO_2 is significantly cheaper than uranium metal. New production methods, less stringent requirements than for fuel manufacture, and potential credits for avoiding disposal of DU as a waste may make the cermets economic for selected transport, storage, and disposal packages.