Innovative and new Container/canister materials under disposal field conditions: Manufacturing feasibility and improved Durability – the InCoManD project (WP9) of the EURAD-2 partnership

AURELIEN DEBELLE[1*], BOJAN ZAJEC[2], ANDREA CHERKOUK[3], HOLGER VÖLZKE[4], PATRICK GANSTER[5], FABRICE ROSSIGNOL[6], URSULA ALONSO DE LOS RIOS[7], MOHAMED MERROUN[8], ANDRESSA TRENTIN[9], JANNE PAKARINEN[9]

[1]Andra, DISTEC, 4-6 Chemin Croix Blanche, 92298 Châtenay-Malabry Cedex, France
[2]Slovenian Nat. Building and Civil Engineering Institute (ZAG), Dimičeva 12, SI-1000 Ljubljana, Slovenia
[3]Helmholtz-Zentrum Dresden-Rossendorf (HZDR), Inst. of Resource Ecology, 01324 Dresden, Germany
[4]Bundesanstalt für Materialforschung und -prüfung (BAM), 12200 Berlin, Germany
[5]Mines Saint-Étienne, Université de Lyon, CNRS, LGF, 158 Cours Fauriel 42023, Saint-Étienne, France.
[6]CNRS, University of Limoges, Institute of Research for Ceramics (IRCER), UMR 7315, European Ceramics Centre, 87068 Limoges, France
[7]CIEMAT – Physical Chemistry of Actinides and Fission Products Unit, Avenida Complutense 40, 28040, Madrid, Spain
[8]Department of Microbiology, Univ. of Granada, Campus Fuentenueva s/n 18071, Granada, Spain
[9]VTT Technical Research Centre of Finland Ltd., Kemistintie 3, FI-02044 Espoo, Finland

** Corresponding author email: aurelien.debelle@andra.fr*

The deep geological disposal of high-level waste (HLW) presents various challenges for container materials, with corrosion resistance being one of the most critical. The lifetimes of HLW components are typically calculated based solely on time-dependent corrosion behaviour. However, coupled mechanical and corrosion degradation modes may occur and modify the container failure time. While the durability of several component materials subjected to corrosion processes only has been extensively studied, the interaction between mechanical processes and corrosion requires further investigation. Assessing the impact of combined degradation modes on component lifetimes will lead to a more robust and defensible safety case. Moreover, the entire engineered barrier system is composed of various materials and characterised by a range of impactful conditions, including water chemistry, microbial activity, stress loads, temperature, and radiation sources. Therefore, specific R&D efforts are needed to understand the long-term performance of the containers in this complex and harsh environment. Another approach to addressing corrosion is to prevent or minimise it, ensuring an even safer disposal, by using for instance ceramic materials, either in a bulk form, or as coatings. Both approaches require the selection of appropriate materials and fabrication/deposition methods, along with the validation of material durability under realistic, accelerated field conditions. The InCoManD work package (WP9), part of the EURAD-2 partnership, will address these issues through a collaborative project involving many countries across Europe (and beyond). Building on the results of ConCorD (WP15 of the EURAD-1 programme), this WP specifically aims to: (i) provide a better understanding of material degradation mechanisms, (ii) define optimised and innovative material solutions, (iii) develop comprehensive predictive models and common methodologies to enhance confidence in the results produced by each partner, and (iv) train new scientists.

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