

A CERAMIC CONTAINER PRODUCED BY GELCASTING: AN ALTERNATIVE CONCEPT FOR THE DISPOSAL OF HIGH-LEVEL RADIOACTIVE WASTE?

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As part of the French Cigeo project, an industrial centre for the geological disposal of radioactive waste led by Andra (the French national radioactive waste management agency), efforts are underway to optimise the disposal conditions of this waste during and after the facility's operating period. This optimisation involves the use of alternative materials to those currently planned (i.e., low-carbon steels) for the cylindrical disposal containers of high-level waste, particularly to mitigate phenomena such as anoxic corrosion. To this end, a research project supported by Andra is exploring the possibility of replacing the steel of the container by a ceramic material. For instance, pure alumina and zirconia-reinforced alumina matrix composites, as will be explained in detail, are a priori less prone to corrosion than steel and, above all, their degradation does not lead to gas production. However, the main drawback of ceramics lies in their sensitivity to microstructural defects, which limits their mechanical properties. The challenge of this doctoral project is, therefore, to develop a manufacturing process that ensures mechanical properties at least equivalent to those of the intended steel containers, with high reliability. To achieve this goal, a gelcasting shaping process, in which Galtenco Solutions is proficient, is being considered. The advantages of this method compared to more conventional approaches will be detailed to highlight its added value at the various stages of ceramic preparation: gelation, drying, presintering, and sintering. The samples have been characterised in terms of both microstructure and mechanical properties (3-point bending), yielding promising initial results. Hence, the aim is to better understand and control the manufacturing process in order to produce the necessary thick-wall containers while ensuring the required mechanical properties.

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