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Perspective

Nuclear Waste and its Intervention in Chemical Industry

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DESCRIPTION

Byproducts from nuclear reactors, fuel processing factories, medical facilities, and research centers include radioactive (or nuclear) waste. Additionally, radioactive waste is produced during the decommissioning and demolition of nuclear reactors and other nuclear facilities. High-level waste and low-level waste are the two main categories nuclear facilities such as nuclear power plants, processing plants for radioactive nuclear fuel, and other nuclear facilities all produce radioactive effluents that contain cesium and strontium isotopes. These radioactive isotopes have half-lives of roughly 30 years, are water soluble, and pose a serious threat to the environment. As a result, they need to be taken out of the wastewater produced by ongoing nuclear energy production and radiation cleanup operations. Due to the possibility of customizing molecular/crystal lattice and higher scale features to immobilize particular radionuclides in an ideal matrix, hierarchical materials with Nano-sized tunnel networks and/or various porosity structures have generated a lot of interest as prospective waste forms. To absorb and remove radionuclides from waste streams, these hierarchical materials-such as zeolites, hex cyanoferrates (metal-HCFs), hollandite's, and zirconium-containing materials-contain nanostructured fillers.

One of the most potential host rocks for the decommissioning of nuclear heat-emitters is salt deposits. The creeping nature of salt facilitates fracture healing and closure. High heat-emitting radioactive waste can be housed there thanks to its high, and its practically zero permeability makes it a great natural barrier that can stop their transit if they are liberated. The remaining drift openings are backfilled with dried crushed salt to restore the host rock's properties and lessen fracturing following the emplacement. The drifts significantly converge as a result of the creep of rock salt, which causes a progressive. It has been thoroughly studied how well salt functions as a host rock for the long-term disposal of heat-generating nuclear waste. The establishment of a firm foundation of knowledge regarding rock salt as a host rock for nuclear waste disposal, in particular, the safety and performance assessments for High-Level Waste (HLW) disposal in the Gorleben salt dome in Germany and the bedded salt formation of the Waste Isolation Pilot Plant (WIPP) in New Mexico, USA.

The lack of study of "real" radioactive plant items restricts efforts to comprehend the mechanics of metallic surface contamination. Because of the radioactive risks, physical restrictions, protracted bureaucracy, and expense associated with handling and transporting "real" samples, they are difficult to obtain. Analysing "real" radioactive materials is crucial, but there is also a strong incentive to create intentionally contaminated surfaces in order to evaluate novel cleaning technology. Then, industry stakeholders would be able to decide on the best decontamination method to use in a certain situation with knowledge. The majority of the research in this review, which summarizes the body of work already done in the topic of radioactive contamination of metallic surfaces, particularly stainless steel, has been done in the last 20 years. Cesium, strontium, and uranium are the three radionuclides with the most published research, whereas lanthanides, actinides, and any other significant radionuclide contamination studies are the groupings of radionuclides with the least amount of research.

CONCLUSION

In terms of architecture, nuclear power plants frequently stand out and have been in use for a considerable amount of time (i.e., decades). This leads to the formation of distinctive contamination and corrosion patterns that are challenging to duplicate. The majority of the documented research on the contamination of stainless steel surfaces nowadays is centered on isolated radionuclide contaminant systems that investigate a wide range of environmental circumstances. The results of these research allow for some inferences. The wide range of operating circumstances that have been evaluated is highlighted by the tabular presentation of the key experimental parameters, making cross-comparison difficult.

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