Forceful Carbonation of Serpentine

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Mineral carbonation has been suggested as an option for long term sequestration of anthropogenic CO2[1]. It is in this respect critical to know whether the growth of carbonate minerals will clog pore space, and thus limit further transport of CO2 into the rock, or whether the carbonate growth will exert enough stress on the host rock to make it fracture, thus making new fluid pathways.

In this work, we perform a numerical study of natural field examples of growth of carbonate minerals in serpentine, and we use a discrete model to reproduce observed structures.

We achieve an improved understanding of the process of mineral carbonation and the feedback on rock deformation, thus improving our ability to determine whether industrial scale mineral carbonation is a viable option for long term storage of CO2.

[1] Kelemen, P.B, and Matter, J.(2008), Proceedings of the National Academy of Sciences of the United States of America, Vol. 105(45): pp. 17295-17300

Limited releases of U and Tc from Hanford tank residual wastes

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Most of the Hanford Tank wastes in Washington, USA are expected to be retrieved, stabilized in an appropriate waste form and then disposed in a repository. Small amounts of residual wastes are expected to remain at the bottom of the tanks in a layer no more than 2.54 cm thick as slurry of solid precipitates. The current final stage of tank closure is planned to consist of the addition of cement or grout to stabilize the remaining wastes and tank structure. In this study, three different chemical treatment methods (lime [$Ca(OH)_2$] addition, an in-situ Ceramicrete based on chemically bonded phosphate ceramics, and a ferrous Iron/Goethite treatment) were tested for their ability to stabilize residual Hanford C-202 tank wastes for reducing contaminant release of Tc and U in particular because they are key groundwater risk drivers.

Leaching tests were conducted using a single-pass flow-through test (SPFT) system with 0.005 M $Ca(OH)_2$ solution for untreated tank sample and C-202 wastes treated with three different chemical treatments. Technetium concentrations in leachates from tank C-202 residual waste treated with the $Ca(OH)_2$, Ceramicrete, and Goethite methods are shown in Fig.1. All three treatments methods effectively reduced the leachable Tc concentrations as well as U to well below untreated waste as a result of formation of insoluble secondary precipitates which can behave like mineral coatings.

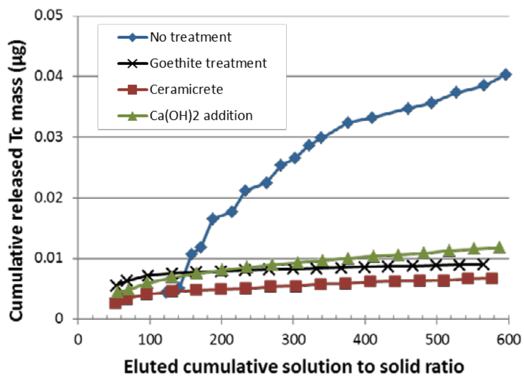

Fig. 1. Released cumulative Tc amounts from the residual wastes.

This innovative approach has the potential to revolutionize Hanford's tank retrieval processes, by allowing larger volumes of residual waste to be left inside tanks while providing an acceptably low level of risk with respect to contaminant release as well as significant cost savings.

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