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Immobilization of long-lived iodine after incorporation into apatite and layered double hydroxide matrices

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Iodine-129 being long-lived volatile fission product, among with cesium-135 and technitium-99, represents a challenge for the design of repository-suited matrices [1]. The present study investigates a possibility of iodine incorporation in the forms of iodide and iodate into apatite and layered double hydroxide matrices. The matrix should meet certain requirements, i.e. being cheap, safe, easy to synthesize, stable and environmental friendly. Optimization of coprecipitation method for synthesis of iodine containing apatite and layered double hydroxide has been done. It was shown that iodide practically does not incorporate in case of apatite and that incorporation is lower in comparison to iodate in case of layered double hydroxide. However, apatite incorporates ca. 5 - 7 % of iodate. Obtained matrices are structurally characterized by XRD and EXAFS methods. EXAFS shows that the iodate-apatite obtained via coprecipitation has different structural iodine environment in comparison to apatite with adsorbed iodate. Thermogravimetric analysis of the iodate-apatite showed the release of iodine at $t > 550^{\circ}\text{C}$.

[1] Watanabe et al. (2009) Appl. Mater. Interf. 1, 1579 –1584.

Primary author: Dr TORAPAVA, Natallia (Leibniz University of Hanover)

Co-authors: Prof. WALTHER, Clemens (Leibniz University of Hanover); IGLESIAS PÉREZ, Luis (Rovira i Virgili University)

Presenter: Dr TORAPAVA, Natallia (Leibniz University of Hanover)

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