TONI TRATNJEK

will present his Ph.D. dissertation

Development of silicotitanates with hierarchical porosity for Strontium capture

The defense will take place on **Friday, December 9 2022** at **9.00 am**

in the ICSM Auditorium

Strontium (^{90}Sr) is present in the nuclear fuel cycle, particularly following the uranium and plutonium recycling stages after which large volumes of aqueous solutions are generated. ^{90}Sr requires special attention due to its high specific activity (4.59×10^{14} Bq/mol) and its half-life ($T_{1/2}$ = 28.8 years). The main objective of this work is to develop materials for Sr adsorption in a column process with the sitinakite phase ($Na_2Ti_2O_3SiO_4.2H_2O$). This phase was selected because its structure is composed of microporous tunnels in which the alkaline earth cation Sr^{2+} sorbs selectively in the aqueous medium. For this purpose, sitinakite powders obtained by hydrothermal synthesis using liquid precursors were characterized to obtain reference materials. Next, sitinakite powders were fabricated using solid precursors in order to prove the feasibility of transforming pre-formed objects into objects with the sitinakite phase. Finally, granules and monoliths with the sitinakite phase were synthesized based on the accumulated knowledge of the previous systems. Thus, sitinakite powders, granules and monoliths with increasing crystallite sizes and tunnel sizes were obtained. The ion exchange properties towards Sr^{2+} and the most problematic competitor cation (Ca^{2+}) were evaluated for the different materials. Sorption kinetics curves of the selected materials were performed with and without the presence of the Ca^{2+} cation to determine the contact times required to reach thermodynamic equilibrium, depending on the properties of the materials. The sorption isotherms of Sr^{2+} with and without the presence of Ca^{2+} were also plotted to determine the maximum sorption capacities of Sr^{2+} in a simplified aqueous medium, free of Ca^{2+}, and in an aqueous medium with strong ionic competition.

Keywords: Decontamination; Strontium; Silicotitanates; Sitinakite; Monoliths; Porous