^{129}I Measurements of Solid Samples

S. Mahnke

The reprocessing facility Mayak (Chelyabinsk, Russia) released radioactive fission products to the environment since its start-up in 1949. Until 1955 the short-lived isotope ^{131}I contributed a considerable amount to the released activity. Through measurements of the ^{129}I-fluence, the ^{131}I-depositionfluence can be reconstructed. This can be achieved via measurements of soil samples from the Chelyabinsk region, because soil constitutes a good archive for ^{129}I. The required time resolution of the ^{129}I-deposition flux has been specified at the MLL by measurements of icecore samples (Altai, Russia) [1]. Additional measurements of ^{129}I-concentrations in annual tree rings shall ascertain the results.

Preparation of the samples

The samples were combusted at 950° C in a stream of oxygen (Fig.1). Prior to the combustion, the samples were air-dried for several days, milled and sieved. All organic material contained in the samples was disposed. For the combustion, aliquots (typically 0.5 - 1 g) were weighed and carrier was added (solid KI, 1 - 4 mg). Former measurements resulted in an isotopic ratio of $^{129}\mathrm{I}/^{127}\mathrm{I} = (5.9{\pm}0.3){\times}10^{-14}$ for the carrier. The samples were then placed in a sample holder inside a quartz tube. Two quarz wool plugs were used to fix the samples inside the sample holder. At one end the quartz tube was connected to an oxygen and nitrogen supply, and at the other end to a bottle containing a trapping solution consisting of 50 ml deionized water with 0.4 ml 7 M NaOH. After combustion, the trapped iodine was extracted into CCl_4 and then back-extracted into deionized water. Finally, the iodine was precipitated as AgI using a solution of 0.1 M $AgNO_3$. The precipitate was centrifugated, washed with deionized water and dried in an oven at 60° C. The dried precipitate was mixed with silver powder and loaded in a sample holder for the AMS measurement.

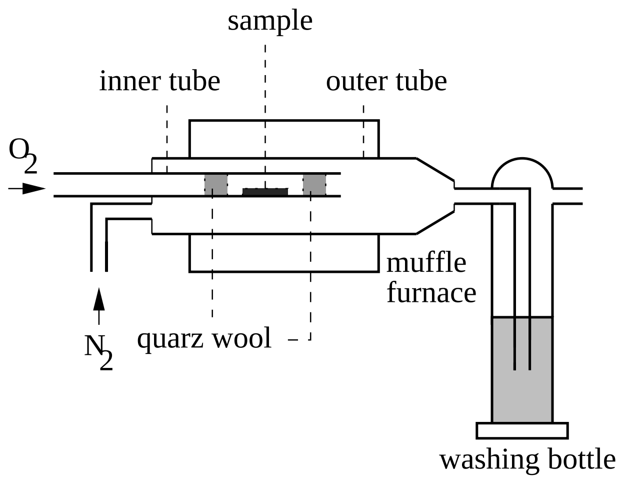

Fig. 1: Experimental set-up for the combustion of solid samples

First results

An incineration furnace for the preparation of solid samples has been installed and a depth profile of ^{129}I in soil has been measured. The samples were taken in Munich. The results shown in Fig.2 prove to be reasonable, compared to former measurements of ^{129}I in soil [3]. Using the fit curve (Fig.2), the total deposition of ^{129}I has been calculated to be 1×10^{14} atoms / m^{-2}. This result shows a good consistency with the expected value [3].

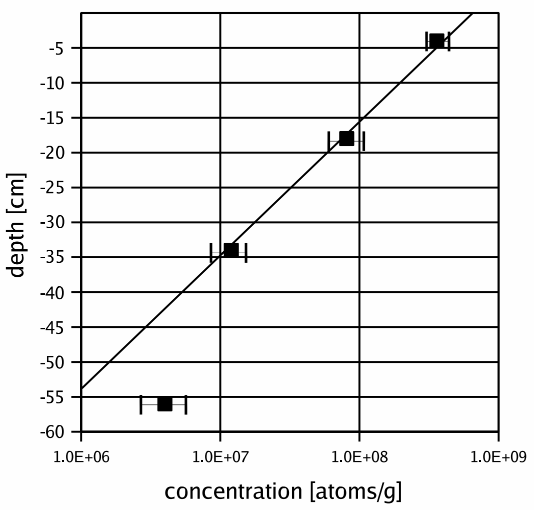

Fig. 2: Measured depth profile for ^{129}I in soil

Outlook

^{129}I-concentrations in tree rings will be measured. Samples have already been taken from a black locust near the reprocessing facility at Marcoule (France). This specific tree is a promising candidate for the observation of a time resolution in the uptake of iodine, because its hydrosystem is limited to the outermost growth ring and thus exchange of iodine between the different annual tree rings should not occur [2].

References

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