Comparative study of the U(VI) complexation onto γ-Al_2O_3 by ATR FT-IR and EXAFS spectroscopy

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Aluminates, representing an essential component of clay minerals, play a decisive role in regulating the mobility of contaminants in rock and soil formations, in particular due to their tendency to form coatings on mineral surfaces [1].

In this work, U(VI) sorption on γ-Al_2O_3 is comparatively investigated using *in situ* vibrational and X-ray absorption spectroscopy. The focus was set to micromolar U(VI) concentrations and a variety of environmentally relevant sorption parameters in order to resolve discrepancies reported earlier [2-4].

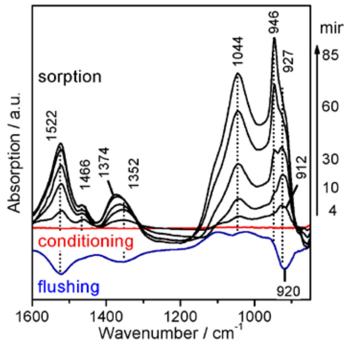

Figure 1: TR ATR FT-IR spectra of U(VI) soprtion on γ-Al_2O_3.

Time-resolved (TR)IR spectroscopic sorption experiments at the alumina-water interface evidence the formation of three different species as a function of surface loading (c. f. Figure 1): a monomeric carbonate complex, an oligomeric surface complex and a surface precipitate. These results are confirmed by IR experiments performed at different flow rates, pH values, ionic strengths, U(VI) concentrations, and in inert gas atmosphere. Results of EXAFS experiments of batch samples are consistent to these findings.

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The role of comets as possible contributors of water and prebiotic organics to terrestrial planets

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The question of exogenous delivery of organics and water to Earth and other young planets is of critical importance for understanding the origin of Earth's water, and for assessing the prospects for existence of Earth-like exo-planets. Viewed from a cosmic perspective, Earth is a dry planet yet its oceans are enriched in deuterium by a large factor relative to nebular hydrogen. Can comets have delivered Earth's water? The deuterium content of comets is key to assessing their role as contributors of water to Earth.

Icy bodies today reside in two distinct reservoirs, the Oort Cloud and the Kuiper Disk (divided into the classical disk, the scattered disk, and the detached or extended disk populations). Orbital parameters can indicate the cosmic storage reservoir for a given comet. Knowledge of the diversity of comets within a reservoir assists in assessing their possible contribution to early Earth, but requires quantitative knowledge of their components – dust and ice. Strong gradients in temperature and chemistry in the proto-planetary disk, coupled with dynamical dispersion of an outer disk of icy planetesimals, imply that comets from KD and OC reservoirs should have diverse composition.

The primary volatiles (native to the nucleus) provide the preferred metric for building a taxonomy for comets, and the number of comets so quantified is growing rapidly. Taxonomies based on native species (primary volatiles) are now beginning to emerge [1, 2, 3]. The measurement of cosmic parameters such as the nuclear spin temperatures for H_2O, NH_3, and CH_4, and of enrichment factors for isotopologues (D/H in water and hydrogen cyanide, $^{14}N/^{15}N$ in CN and hydrogen cyanide) provide additional tests of the origin of cometary material. I will provide an overview of these aspects, and implications for the origin of Earth's water and prebiotic organics

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