Modified montmorillonite as tool for exploring diffusion pathways for anions and cations

LUC R. VAN LOON*[2], ELISABETH FETZ[1], WOLFGANG HUMMEL[2], MICHAEL PLÖTZE[1]

[1] Institute for Geotechnical Engineering, ETH Zurich, CH-8093 Zürich, Switzerland

[2] Laboratory for Waste Management, Paul Scherrer Institut, CH-5232 Villigen PSI, Switzerland (*correspondence: luc.vanloon@psi.ch)

In montmorillonite differently charged species diffuse in different types of pore spaces [1,2]. Whereas for cations and neutral species the whole pore space (interlayer pore space, interparticle pore space) is accessible, anions are assumed to diffuse only in the uncharged pore space [1,3], or also in the total pore space [4]. Diffusion of anions is thus still controversily discussed in the literature. The use of targeted modified montmorillonite (i.e. by using differently modified montmorillonites and by studying the effect of this modification on the diffusion behaviour of water, cations and anions) might help to shed more light on this item.

The modification of the interlayer pores can be done by enlargement and blocking. The enlargement can be achieved by pillaring [5]. Pillaring agents such as Al prop apart the interlayer pore space and with such an enlarged interlayer even anions potentially might be able to diffuse through the interlayer. The blocking of the interlayer can be achieved with an agent like guanidinium [6] that strongly adsorbs in the interlayer leaving no space for other molecules, or by collapsing the interlayer by alternate wetting and drying of K^+-montmorillonite [7]. With blocking, even water might be unable to move through the interlayer and is forced to diffuse through the interparticle pore space.

The diffusion of HTO, $^{22}Na^+$ and $^{36}Cl^-$ in compacted modified montmorillonite was studied and compared with unmodified montmorillonite. First results showed that pillar-ing did not have a significant effect on the diffusion of HTO, but largely affected the diffusion of both $^{22}Na^+$ and $^{36}Cl^-$. Blocking of the interlayer also significantly affected the diffusion behaviour of ions, but not diffusion of HTO.

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