Contribution ID: **629** Type: **Poster**

Combined wicking and drying of a NaCl solution in porous media as studied by NMR

Monday, 14 May 2018 17:00 (15 minutes)

Salt are a major cause of destruction by crystallization of porous media. Salt will in general enter a porous medium by advection with moisture or diffusion within the moisture. A special situation which occurs often in marine environments in which case there is a permanent supply of sea water at one side of a porous material such as a concrete structure. At the other side, the structure is exposed to continuous drying in the open air. In such a case there will be a mixed situation for describing the transport. Evaporation from the air exposed side provides a continuous moisture sink which is compensated by capillary suction, i.e., wicking, of the sea water. As a result there will be a continuous flux of NaCl ions to the surface. As a result of this combined process the NaCl concentration at the drying surface will increase slowly until crystallization starts. Using a specially designed Nuclear Magnetic Resonance (NMR) setup, the 1H, 23Na and 35Cl content can measured quasi-simultaneously. Hence this NMR method gives us the possibility for real-time monitoring of transport processes of the ions during experiments. We have measured the transport of the both Na and Cl during this combined process for both a sandstone and concrete. The results can be described by a simple analytic model which indicates the concentration profiles can be described an exponential decay.

References

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Session Classification: Poster 1

Track Classification: GS 3: Experimental achievements