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# Numerical Simulation with LAGAMINE for Coupled THM Mockup Test under Repository Relevant Loading Scenarios

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Abstract:

A simulation exercise using FE code LAGAMINE (University of Liege) was conducted to examine the model response under various possible loading paths relevant to the deep geological disposal of high-level radioactive waste with two different soil water retention models, classical van Genuchten model (1980) and Dieudonne model (2017). For all simulation cases, a 2D axisymmetric model along Y-axis is selected having model dimensions identical to highly compacted sand bentonite sample in column-experiment (diameter along X-axis = 0.15 meter and height along Y-axis 0.30 meter). The column-testing program for phenomenological modelling of compacted buffer material deduces the model dimensions and applied boundary conditions. In this regard, an innovative column type-testing device is designed and implemented at Ruhr-Universität Bochum, Germany. Fig. 1 shows the technical and constructional features of the column-testing device. The simulation results showed that the wetting and heating induced stresses are dependent applied coupled loading sequence in terms of temperature and hydration. The degree of saturation governs both wetting induced total stresses and heat induced pore water pressure. The role of technical voids in the buffer re-saturation process was investigated by simulating the two kinds of technical gaps during hydration. During the simulation with technical voids, the wetting induces total stresses depends upon the mean density irrespective of gap orientation. Although the technical voids accelerate the buffer re-saturation process as compare to the case with no technical voids.

References:

1. van Genuchten, M. T. (1980). A closed-form equation to predict the hydraulic conductivity of unsaturated soils, Soil Science Society of America Journal 44, No. 5, 892-898.

2. Dieudonne, A. C., Della Vecchia, G., Charlier, R. (2017). Water retention model for compacted bentonites, Canadian Geotechnical Journal, Vol. 54, 915-925.

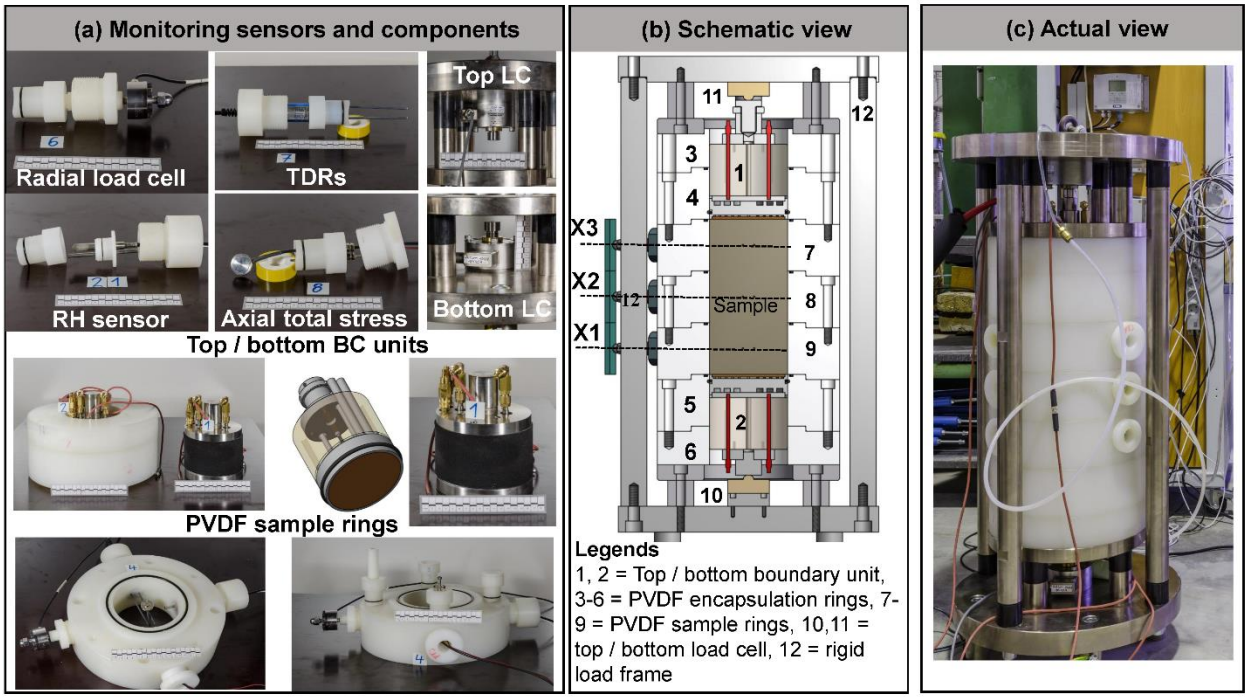


**FIG. 1. Technical and constructional features of newly designed column-testing device at Ruhr- Universität Bochum, (a) monitoring sensors and assembling components, (b) schematic view, and (c) actual view. In the schematic view, X1, X2 and X3 are three measurement sections.**