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Supplementary Material

COMPACTION-INDUCED NON-MONOTONIC VARIATION OF LONGITUDINAL DISPERSION COEFFICIENT IN GRANULAR MEDIA

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APPENDIX

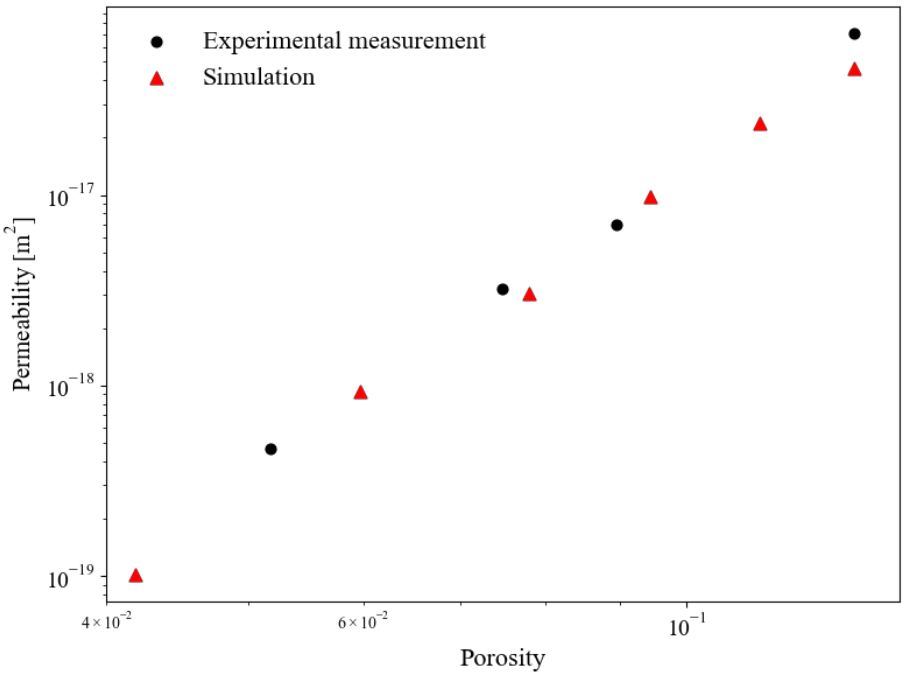

Figure S1: Permeability–porosity relationships for sphere packs obtained from numerical simulations and experimental measurements (51). In the simulations, pore structures were generated through cold compaction modeled by discrete element method (DEM) and solid-state hot sintering simulated using a cellular automata algorithm, while permeability was calculated using the lattice Boltzmann method.

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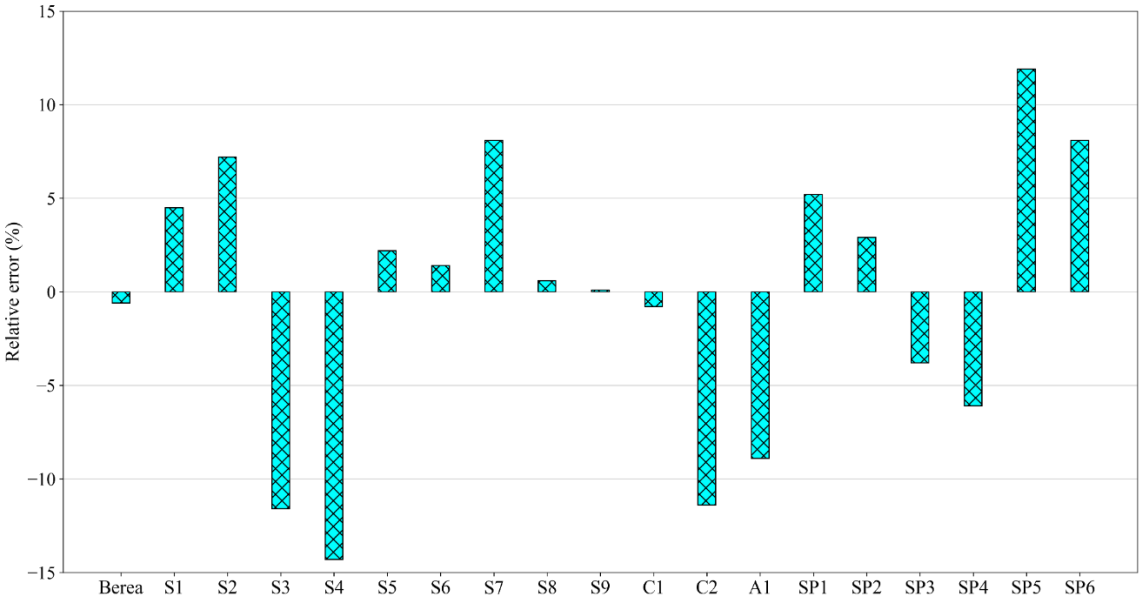

Figure S2: The relative errors in the predicted absolute permeability by pore network models (PNM). The relative error is defined as $\left(\left(K_x^P + K_y^P + K_z^P\right) - \left(K_x^L + K_y^L + K_z^L\right)\right)/\left(K_x^L + K_y^L + K_z^L\right)$, where K_x^P, K_y^P, and K_z^P denote the absolute permeability along the x, y, and z directions of the media, as predicted by pore network models, while K_x^L, K_y^L, and K_z^L are the corresponding reference values obtained from (Lattice Boltzmann Method) LBM simulations. Samples include sandstone (Berea and S1-S9), carbonate (C1-C2), and sand pack (A1) (36). The average relative error for these samples is 5.8%.

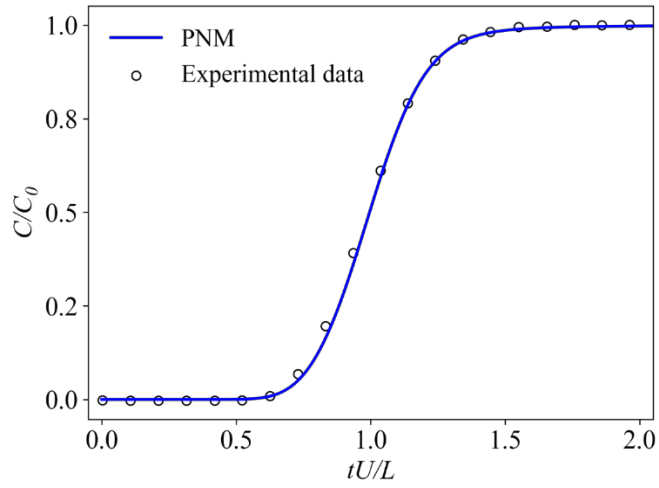

Figure S3: Comparison of breakthrough curve of solute concentration in the bead pack. $U = 9.3 \times 10^{-4}$ m/s is the mean velocity, t denotes the injection time, and $L = 180$ mm is the column length. The relative error in the predicted breakthrough curve is 0.8%. The relative error is defined as: $E = \frac{1}{N_0}\sum_{i \le N_0}\left|C_i^{ref} - C_i^{PNM}\right|$, where C_i^{ref} represents the i^{th} value of breakthrough curves in the experimental data, C_i^{PNM} represents results by PNM simulations at the corresponding times of the reference dataset, and N_0 denotes the number of data points.

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