Machine Learning for the Characterization of Porous Transport Layers

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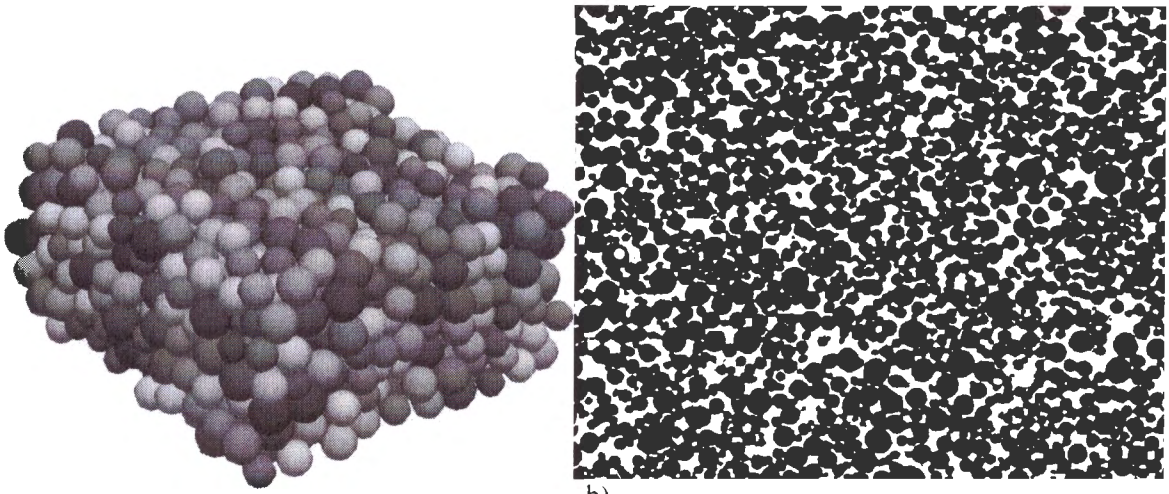
The geometric micro-structure of porous transport layers (PTLs) affects their permeability, in accordance with Darcy's law. As a material property, it is relevant for transport simulations at higher scales [1], at both the cell and stack levels of fuel cells and electrolyzers.
As a continuation of previous investigations into the application of convolutional neural networks (CNNs) [2], sphere-based micro-structures were investigated, as they can be used for PTLs in electrolyzers. A sedimentation model was developed to create stochastic sphere-based micro-structures (Figure 1). With the permeability calculated by means of a Lattice–Boltzmann simulation, a CNN was developed in order to predict the permeability of a material given by its three-dimensional (3D) micro-structure (Figure 2). The predictions of the CNN were of reasonable accuracy for material that was sintered from spherical particles [3].



a) b)

Figure 1. Micro-structures of porous transport layers (PTLs); a) stochastic micro-structure, created by sedimentation of the spheres [3]; b) PTL by sintered titanium spheres [3]. 2D slice from a 3D structure.

References:

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2. D. Froning, E. Hoppe, R. Peters. The Applicability of Machine Learning Methods to the Characterization of Fibrous Gas Diffusion Layers, *Appl. Sci.* **13** (2023) 6981. https://doi.org/10.3390/app13126981
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