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Estimation of large domain AI foam permeability by Finite Difference methods

[Maria Osorno](#), [Holger Steeb](#), [David Uribe](#) , [Oscar Ruiz](#)**First published:**29 November 2013 [Full publication history](#)**DOI:**10.1002/pamm.201310119 [View/save citation](#)**Cited by:**0 articles [Citation tools](#)

Abstract

Classical methods to calculate permeability of porous media have been proposed mainly for high density (e.g. granular) materials. These methods present shortcomings in high porosity, i.e. high permeability media (e.g. metallic foams). While for dense materials permeability seems to be a function of bulk properties and occupancy averaged over the volume, for highly porous materials these parameters fail to predict it. Several authors have attacked the problem by solving the Navier-Stokes equations for the pressure and velocity of a liquid flowing through a small domain (Ω_s) of aluminium foam and by comparing the numerical results with experimental values (prediction error approx. 9%). In this article, we present calculations for much larger domains (Ω_L) using the Finite Difference (FD) method, solving also for the pressure and velocity of a viscous liquid flowing through the Packed Spheres scenario. The ratio $Vol(\Omega_L)/Vol(\Omega_s)$ is around 10^3 . The comparison of our results with the Packed Spheres example yields a prediction error of 5% for the intrinsic permeability. Additionally, numerical permeability calculations have

been performed for AI foam samples. Our geometric modelling of the porous domain stems from 3D X-ray tomography, yielding voxel information, which is particularly appropriate for FD. Ongoing work concerns the reduction in computing times of the FD method, consideration of other materials and fluids, and comparison with experimental data. (© 2013 Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim)

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