



POREEXPERT

Getting Started Guide

1. Welcome

Thank you for using PoreXpert, which we hope will provide an extremely useful and interesting experience. PoreXpert and its predecessor Pore-Cor have been used in 20 countries worldwide - and the feedback we have received has guided the continual development of the software. Your own feedback is particularly welcomed via the website www.porexpert.com.

PoreXpert is highly automated, with comprehensive in-built help, but is a vast and highly complicated package. Therefore please devote time to understand how to use it properly and productively, in particular avoiding artefacts as detailed in Section 1.4 below.

1.1. Purpose of the software

As someone working with porous materials, you will be aware how difficult they are to characterise. Microscopy gives a 2-dimensional view, with no information about the 3-dimensional connectivity of voids – and it is that connectivity which hugely affects properties such as the permeability, diffusion and trapping of pore fluids, and filtration characteristics. Microtoming gives information layer by layer, but connections of voids between layers have to be guessed. Tomography gives a 3-dimensional mapping of the voids, but not to sufficiently high resolution to give all the interconnections. Percolation characteristics, gained from mercury intrusion, water retention or porometry, give clues about the inter-connectivity of the voids, but give no explicit information about large voids hidden by smaller voids or connections.

PoreXpert is designed to bring all this partial information together, by constructing a realistic simulation of your porous material. The implicit and endemic approximation in the literature – invoked every time you take the slope of a mercury intrusion, water retention or porometry curve – is that the pore structure comprises a bundle of capillary tubes of different sizes – a bundle of different sized drinking straws, if you like. Just like the drinking straws, the assumption is that they are not inter-connected. For a very few materials, such as track etch membrane filters, this assumption is correct – and you can explicitly generate such a structure in PoreXpert. However, for most materials, it is not – the fully interconnected PoreXpert structure is very much closer to reality. The shapes of the features in the PoreXpert structure are simplistic – boxes connect by tubes – but for most practical purposes void shapes do not matter – it is the cross-sectional sizes and interconnectivity of the voids that really matter, and those are matched quantitatively to the experimental information you supply.

The arrays of boxes connected by tubes are clumped together in blocks, which can be cubic or cuboid (long and thin or flat square plate). These clumps are known as 'Unit Cells'. The Unit Cells connect at every void feature to identical Unit Cells in every direction to represent the overall porous material. Clearly it is beneficial to have the Unit Cells as big as possible to reduce the number of repetitions required and to avoid any strange artefacts caused by the repetition – but the computing power required goes up steeply with the size of the Unit Cell.

Once the structure is generated, a large amount of information can be gained about it, and downloaded in a variety of formats, e.g. for quality control purposes. Then a wide range of properties can be calculated, including permeability, wettability, diffusion, filtration and thermal conductivity.

And a very important feature of the software is *What if ?*, for example :

-  how will my material age?
-  how will my material react to perturbations such as compression ?
-  how will the permeability change if my material is flooded with small particles ?
-  how will its filtration characteristics be altered if I enlarge all the smallest voids by 10% ?
-  to what extent do wetting and non-wetting gases and liquids intrude or flow through it ?

The features of PoreXpert are designed to move you beyond trial and error optimisation of your product, and into tailored engineering and design.

1.2. PoreXpert version 3

PoreXpert version 3 is a further major upgrade. The new features in version 3 allow the use of image-analysed electron micrographs as input data, and give a more powerful interpretation of porometry. It also recognises that the absolute permeability estimate from PoreXpert needs calibration. So the output from the permeability calculation is displayed as Network Capacity, and an estimate of the actual absolute permeability is shown, together with a qualitative descriptor of the confidence in that estimate.

Version 3 also includes all of the powerful algorithms provided with version 2, including a unique, patented, automated method of identifying which voids are likely to be clusters. Many improvements to these algorithms are included in version 3 - including better usability via file name prompts and more informative operations list, improved tortuosity simulation, improved batch progress and build notifications, and updated csv and pdf reporting.

1.3. Language

The language of PoreXpert can be changed instantly between English, German, French, Italian, Spanish and Portuguese. For instructions on how to change language on-the-fly, go to the **Search** (magnifying glass) icon of the Help system <https://porexpert.com/help3/>, and search for **Language | Licences and Versions > International Versions**.

1.4. Avoiding artefacts

It is easy to create artefacts with PoreXpert – i.e. results and trends which, rather than being really associated with your materials, result from approximations within the software. It is therefore highly recommended that you carry out the relevant tutorials on the Help system, available from the question mark icons when you are using the software, or as stand-alone instructions via the PoreXpert website's **Software Support | Help, and User manual** page (<https://porexpert.com/help3/>), or, if you are a member of a team using PoreXpert, book a training course via **Software Support | Support and Training**.

1.5. Other products

1.5.1. PoreXY

PoreXY is the PoreXpert porosimetry pre-processor, available free to all who register on the website. It corrects for and measures sample solid-phase compressibility (bulk modulus). It also allows easy trimming and thinning of data, for improved input to PoreXpert and easier calculation of the first derivative (slope) of the intrusion curve. It is highly recommended that you pre-process all porosimetry datafiles before input to PoreXpert to avoid artefacts.

1.5.2. PoreXpert Flex

A pay-as-you-go version of PoreXpert, currently under development.

2. Installation

2.1. Minimum System Requirements

The better your computer, the more you will be able to do with PoreXpert, which is designed to utilise your computer's maximum possible capacity, running it in parallel if possible.

- Windows 10 / 11
- Spare USB Port for copy protection dongle for PoreXpert and PoreXpert Professional
- Multi core processor
- 4GB RAM.
- Dedicated graphics card so that you can use the virtual reality viewer for larger unit cell sizes.
- Internet access for the latest Help, registration of the software and downloading updates of the software.

2.2. Installation Instructions

Got to the PoreXpert website (www.porexpert.com) , and follow the instructions at

Software Support | Installation (i.e. at <https://www.porexpert.com/support/installation/>)

3. Using PoreXpert

3.1. Keyboard Shortcuts

To run a new operation use **Ctrl + [number]**, to add an operation in batch mode use **Shift + [number]**. The numbers are assigned in series as follows:

	Operation	Running	PoreBatch
Initialisation	Sampling	Ctrl + 1	-
	Fitting	Ctrl + 2	Shift + 2
	Building	Ctrl + 3	Shift + 3
Engineering	Targeted Modification	Ctrl + T	Shift + T
Calculation	Permeability	Ctrl + 4	Shift + 4
	Conductivity	Ctrl + 5	Shift + 5
	Tortuosity	Ctrl + 6	Shift + 6
	Filtration	Ctrl + 7	Shift + 7
	Fluid Uptake	Ctrl + 8	Shift + 8
	Fluid Migration	Ctrl + 9	Shift + 9
Analysis	Connectivity Distribution	Ctrl + Alt + 1	Shift + Alt + 1
	Content Distribution	Ctrl + Alt + 2	Shift + Alt + 2
	Pore And Throat Size Distribution	Ctrl + Alt + 3	Shift + Alt + 3
	Microtoming	Ctrl + Alt + 5	Shift + Alt + 5
	Fluid Uptake Progress	Ctrl + Alt + 6	Shift + Alt + 6
Batch	Run batch operations locally	-	Shift + R
	Run batch in the cloud	-	Shift + C

4. Frequently Asked Questions

Go to the **Search** (magnifying glass) icon of the Help system <https://porexpert.com/help3/>, and search for **FAQ**.