

Comparative Methods for the Pore Size Distribution of Woven and Metal Filter Media

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Abstract

This paper investigates the comparability of several multi-layered, woven filter media using air, water and bubble point methods. Estimated filter efficiencies from the bubble point measurements were then compared to a new sonic challenge test method where precision micropheres are flushed through the pores. Inconsistencies in the bubble point filter efficiencies were found to be dependent on the openness or permeability of the weave. The filter efficiency of a non-woven metal filter medium was then related to the pore size distribution measured by microscopy.

Key words: Permeability, woven filter media, metal filter media

1. Introduction

In order to permit clean filter through materials the pore structure is clearly defined as often viewed under a microscope an aperture can be observed with increased definition from the side and end walls. However, Figure 1(a), in most cases it is possible to measure across the opening (in each direction) to get an indication of the pore width/size.

Microscopic aperture measurement is not possible however on composite or double-layered weaves (CFLC) structures similar to those in Figure 1 (b). When viewed from the top surface it is difficult to see through the fibres (unless it is extremely loose). In most cases the cross-sectional path through a composite or CFLC is a tortuous one with interweaving between the layers. Furthermore, increasingly lighter weaves in the same weave class, become severely fine; the use of microscopy as an analytical tool to measure aperture size.

In complex, 3-dimensional filter media, permeability via capillary flow from wetted media has long been used for assessing the relative pore size distribution (RSDC). Theoretically it is based on the Laplace equation for cylindrical capillary pores (ASTM F-330-80 and (see ASTM)). However, most filter media have irregular pores, which makes the theoretical assumptions suspect and this is especially the case in multi-layered structures. Nevertheless, permeability has been firmly established as a low cost procedure for filter media characterisation, and now can even be successfully used to assess efficiency.

Many investigators used the rigorous bubble point method for RSDC determinations, but with the advent of the Coulter's permeometer in 1988 this task has become relatively easy. In the ensuing years many other permeometers have been introduced.

Using multi-layered woven media, as shown in Figure 1, this paper compares four methods of pore size analysis based on permeability testing. In addition it will compare permeability data with that of direct so-called 'Challenge test'. In this method standard test dusts or glass beads are presented to a filter medium and the particles in the downstream phase analysed.

In the least development of the method, accurately calibrated, narrow size distribution glass microspheres have been produced covering the size range 2 - 500µm in 20 grades. Knowing the size distribution by weight eliminates the need for particle sizing equipment as the pore size can be directly related to the percentage of the standard passing the filter medium through a calibration graph or formula.



(a) A 2D view (b) Double layered weave
 Figure 1.

Comparative Methods For The Pore Size Distribution

Katrin Zwirgmaier



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Characterisation of Porous Solids V G. Kreysa, J.P. Baselt, K.K. Unger, 2000-04-11 The Fifth International Symposium on the Characterisation of Porous Solids COPS V was held at Heidelberg Germany from May 30 to June 2 1999 About 220 participants from 25 countries enjoyed a very successful meeting with 32 lectures and 155 poster presentations The Symposium started with a highly stimulating lecture by Sir John Meurig Thomas Cambridge highlighting the recent developments in engineering of new catalysts The following two full sessions were devoted to theory modelling and simulation which provide the basis for the interpretation of pore structural data of adsorbents and finely dispersed solids Sessions 2 and 3 focused on the advances in the synthesis and characterisation of highly ordered inorganic adsorbents and carbons Sessions 4 and 5 addressed important questions with respect to the characterisation of porous solids by sorption measurement and other related techniques The intensive three day programme provided a stimulating forum for the exchange of novel research findings concepts techniques and materials which are collected in this volume

Molten Salts Chemistry Frederic Lantelme, Henri Groult, 2013-08-14 Molten salts and fused media provide the key properties and the theory of molten salts as well as aspects of fused salts chemistry helping you generate new ideas and applications for fused salts *Molten Salts Chemistry From Lab to Applications* examines how the electrical and thermal properties of molten salts and generally low vapour pressure are well adapted to high temperature chemistry enabling fast reaction rates It also explains how their ability to dissolve many inorganic compounds such as oxides nitrides carbides and other salts make molten salts ideal as solvents in electrometallurgy metal coating treatment of by products and energy conversion This book also reviews newer applications of molten salts including materials for energy storage such as carbon nano particles for efficient super capacitors high capacity molten salt batteries and for heat transport and storage in solar plants In addition owing to their high thermal stability they are considered as ideal candidates for the development of safer nuclear reactors and for the treatment of nuclear waste especially to separate actinides from lanthanides by electrorefining Explains the theory and properties of molten salts to help scientists understand these unique liquids Provides an ideal introduction to this expanding field Illustrated text with key real life applications of molten salts in synthesis energy nuclear and metal extraction

Recent Advances in the Science and Technology of Zeolites and Related Materials C. Claeys, 2004 *Recent Advances in Science and Technology of Zeolites and Related Materials* is a collection of oral and poster communications presented during the 14th International Zeolite Conference IZC The conference was hosted by the Catalysis Society of South Africa In the tradition of the IZC series this Conference provides a forum for the presentation of new knowledge in the science and technology of zeolites and related materials Papers presented cover a wide range of topics that include synthesis structure determination characterisation modelling and catalysis This highly visual book is a must for readers looking to stay up to date on zeolite science This three part volume provides valuable information on zeolites and related materials Includes papers that

cover topics such as structure determination modelling and separation processes Contains new and exciting developments in the field Characterization of Porous Solids VI ,2002-11-14 This book contains 99 of the papers that were presented at the 6th in the series of Symposia on Characterization of Porous Solids held in Alicante Spain May 2002 Written by leading international specialists in the subject the contributions represent an up to date and authoritative account of recent developments around the world in the major methods used to characterize porous solids The book is a useful work of reference for anyone interested in characterizing porous solids such as MCM 41 mesoporous materials pillared clays etc Papers on pore structure determination using gas adsorption feature strongly together with papers on small angle scattering methods mercury porosimetry microcalorimetry scanning probe microscopies and image analysis **Nanoporous Materials II** T.J. Pinnavaia,Abdel Sayari,M. Jaroniec,2000-04-14 The first symposium on Access in Nanoporous Materials was held in Lansing Michigan on June 7 9 1995 The five years that have passed since that initial meeting have brought remarkable advances in all aspects of this growing family of materials In particular impressive progress has been achieved in the area of novel self assembled mesoporous materials their synthesis characterization and applications The supramolecular self assembly of various inorganic and organic species into ordered mesostructures became a powerful method for synthesis of mesoporous molecular sieves of tailored framework composition pore structure pore size and desired surface functionality for advanced applications in such areas as separation adsorption catalysis environmental cleanup and nanotechnology In addition to mesostructured metal oxide molecular sieves prepared through supramolecular assembly pathways clays carbon molecular sieves porous polymers sol gel and imprinted materials as well as self assembled organic and other zeolite like materials have captured the attention of materials researchers around the globe The contents of the current volume present a sampling of more than 150 oral and poster papers delivered at the Symposium on Access in Nanoporous Materials II held in Banff Alberta on May 25 30 2000 About 70% of the papers are devoted to the synthesis of siliceous mesoporous molecular sieves their modification characterization and applications which represent the current research trend in nanoporous materials The remaining contributions provide some indications on the future developments in the area of non siliceous molecular sieves and related materials This book reflects the current trends and advances in this area which will certainly attract the attention of materials chemists in the 21st century *Petroleum Generation, Migration and Storage in Shale System* Xiaomin Xie,Feng Yang,Jianhua Zhao,Juan Teng,Tao Hu,Chunqing Jiang,Jun Wang,2023-11-16 Shale resource systems include conventional source rocks unconventional resources such as shale gas and shale oil system Regardless of the type of shale resource system the issues of petroleum formation processes including petroleum generation migration and storage are very important in petroleum evaluation and exploration Because of the complicated and different geological settings in the world the evaluation approaches and workflows may not be easily implemented following those from successful examples Thus the mechanisms of petroleum formation are fundamental for petroleum exploration and production all over in the world

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Dielectric Films for Advanced Microelectronics Mikhail Baklanov, Martin Green, Karen Maex, 2007-03-19 The topic of thin films is an area of increasing importance in materials science electrical engineering and applied solid state physics with both research and industrial applications in microelectronics computer manufacturing and physical devices Advanced high performance computers high definition TV broadband imaging systems flat panel displays robotic systems and medical electronics and diagnostics are a few examples of the miniaturized device technologies that depend on the utilization of thin film materials This book presents an in depth overview of the novel developments made by the scientific leaders in the area of modern dielectric films for advanced microelectronic applications It contains clear concise explanations of material science of dielectric films and their problem for device operation including high k low k medium k dielectric films and also specific features and requirements for dielectric films used in the packaging technology A broad range of related topics are covered from physical principles to design fabrication characterization and applications of novel dielectric films

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