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FLOW OF GASES THROUGH POROUS MEDIA

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SURFACE AREA DETERMINATION

THE DIFFUSION AND FLOW OF GASES THROUGH POROUS MEDIA

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GAS TRANSPORT IN POROUS MEDIA

Springer Science & Business Media CLIFFORD K. HOAND STEPHEN W. WEBB Sandia National Laboratories, P. O. Box 5800, Albuquerque, NM 87185, USA Gas and vapor transport in porous media occur in a number of important applications includingdryingofindustrialandfoodproducts,oilandgasexploration,environm- tal remediation of contaminated sites, and carbon sequestration. Understanding the fundamental mechanisms and processes of gas and vapor transport in porous media allows models to be used to evaluate and optimize the performance and design of these systems. In this book, gas and vapor are distinguished by their available states at stan- ? dard temperature and pressure (20 C, 101 kPa). If the gas-phase constituent can also exist as a liquid phase at standard temperature and pressure (e. g. , water, ethanol, toluene, trichlorothylene), it is considered a vapor. If the gas-phase constituent is non-condensable at standard temperature and pressure (e. g. , oxygen, carbon di- ide, helium, hydrogen, propane), it is considered a gas. The distinction is important because different processes affect the transport and behavior of gases and vapors in porous media. For example, mechanisms specific to vapors include vapor-pressure lowering and enhanced vapor diffusion, which are caused by the presence of a g- phase constituent interacting with its liquid phase in an unsaturated porous media. In addition, the “heat-pipe” exploits isothermal latent heat exchange during evaporation and condensation to effectively transfer heat in designed and natural systems.

MEASUREMENTS OF THE FLOW OF GASES THROUGH POROUS MEDIA BY THE PRESSURE DECAY METHOD

THE FLOW OF GASES AND VAPOURS THROUGH ABSORBING POROUS MEDIA

"Fluid flow has been measured through almost every type of porous material. A considerable portion of these permeability studies has been directed towards the flow of gases through a bed of charcoal grains. The interest in gas flow through charcoal arises from the ability of charcoal to separate one gas from another, and this property has been widely applied both in chemical warfare and industry. It is of fundamental importance to the knowledge of gas flow through a bed of charcoal grains to understand the process by which the sorbable gas is carried into the interior of the charcoal grain. [...]" --

FLOW OF GASES THROUGH CONSOLIDATED POROUS MEDIA.

THE FLOW OF GASES AND VAPOURS THROUGH POROUS MEDIA

FLOW OF GASES AND VAPORS THROUGH POROUS MEDIA

DIFFUSION IN GASES AND POROUS MEDIA

Springer The world we live in exhibits, on different scales, many phenomena related to the diffusion of gases. Among them are the movement of gases in earth strata, the aeration of soils, the drying of certain materials, some catalytic reactions, purification by adsorption, isotope separation, column chro matography, cooling of nuclear reactors, and the permeability of various packing materials. The evolution of the understanding of this subject has not always been straightforward and progressive-there has been much confusion and many doubts and misunderstandings, some of which remain to this day. The main reason for the difficulties in the development of this subject is, we now know, the lack of an understanding of the effects of walls on diffusing systems. Textbooks usually treat diffusion on two levels: at the physicochemi cal or molecular level, making use of the kinetic theory of gases (which while a very rigorous and well-founded theory nevertheless is valid only for systems without walls), or at the level of a transport phenomenon, a level geared toward applications. The influence of walls is usually disregarded or is treated very briefly (for example, by taking account of the Knudsen regime or by introducing a transition regime of limited validity) in a way unconnected with previous studies. As a consequence, the extensive, gener alized, and well-founded knowledge of systems without walls has often been applied without sound basis to real situations, i.e., to systems with walls.

TRANSIENT FLOW OF IDEAL AND REAL GASES THROUGH POROUS MEDIA

FLOW OF AIR AND NATURAL GAS THROUGH POROUS MEDIA

FLOW OF GASES THROUGH AND OVER POROUS MATERIALS

NONLINEAR PARABOLIC EQUATIONS: GENERALIZED FLOW OF GASES THROUGH POROUS MEDIA

FLOW OF REAL GASES THROUGH POROUS MEDIA

NON-DARCY FLOW OF GAS THROUGH POROUS MEDIA IN THE PRESENCE OF SURFACE ACTIVE AGENTS

APPLICATIONS OF THE FLOW OF GAS THROUGH POROUS MEDIA

FLOW AND DIFFUSION OF GASES THROUGH POROUS MEDIA

THE FLOW OF GASES THROUGH POROUS INORGANIC MEDIA

THE RADIAL FLOW OF GAS THROUGH POROUS MEDIA USING ERGUN EQUATION

THE PHYSICS OF FLOW THROUGH POROUS MEDIA

APPROXIMATE EQUATIONS FOR THE DIFFUSION AND FLOW OF GASES IN POROUS MEDIA

THE FLOW OF HOMOGENEOUS FLUIDS THROUGH POROUS MEDIA

FLUID FLOW IN POROUS MEDIA

Wspc (Europe) This book presents, in a self-contained form, the equations of fluid flow in porous media, with a focus on topics and issues that are relevant to petroleum reservoir engineering. No prior

knowledge of the field is assumed on the part of the reader, and particular care is given to careful mathematical and conceptual development of the governing equations, and solutions for important reservoir flow problems. Fluid Flow in Porous Media starts with a discussion of permeability and Darcy's law, then moves on to a careful derivation of the pressure diffusion equation. Solutions are developed and discussed for flow to a vertical well in an infinite reservoir, in reservoirs containing faults, in bounded reservoirs, and to hydraulically fractured wells. Special topics such as the dual-porosity model for fractured reservoirs, and fluid flow in gas reservoirs, are also covered. The book includes twenty problems, along with detailed solutions. As part of the Imperial College Lectures in Petroleum Engineering, and based on a lecture series on the same topic, this book provides the introductory information needed for students of the petroleum engineering and hydrology.

FLOW OF CAPILLARY-CONDENSIBLE GASES THROUGH POROUS MEDIA

FLUID FLOW IN POROUS MEDIA: FUNDAMENTALS AND APPLICATIONS

World Scientific Processes of flow and displacement of multiphase fluids through porous media occur in many subsurface systems and have found wide applications in many scientific, technical, and engineering fields. This book focuses on the fundamental theory of fluid flow in porous media, covering fluid flow theory in classical and complex porous media, such as fractured porous media and physicochemical fluid flow theory. Key concepts are introduced concisely and derivations of equations are presented logically. Solutions of some practical problems are given so that the reader can understand how to apply these abstract equations to real world situations. The content has been extended to cover fluid flow in unconventional reservoirs. This book is suitable for senior undergraduate and graduate students as a textbook in petroleum engineering, hydrogeology, groundwater hydrology, soil sciences, and other related engineering fields.

PART I: THE FLOW OF GASES AND VAPOURS THROUGH POROUS MEDIA

PART II: THE PREPARATION AND PROPERTIES OF VINYL RADICALS

MECHANICS OF OIL AND GAS FLOW IN POROUS MEDIA

Springer Nature This book discusses various aspects of percolation mechanics. It starts with the driving forces and driving modes and then examines in detail the steady state percolation of single-phase incompressible fluids, percolation law of natural gas and percolation of non-Newtonian fluids. Progressing from simple to complex concepts, it also analyzes Darcy’s law, providing a basis for the study of reservoir engineering, oil recovery engineering and reservoir numerical simulation. It serves as a textbook for undergraduate students majoring in petroleum engineering, petroleum geology and groundwater engineering, and offers a valuable reference guide for graduate students, researchers and technical engineers engaged in oil and gas exploration and development.

FLOW OF AIR AND NATURAL GAS THROUGH POROUS MEDIA

FLOW OF NATURAL GAS THROUGH HIGH-PRESSURE TRANSMISSION LINES

A JOINT REPORT

LABORATORY TEST METHOD FOR UNSTEADY-STATE GAS FLOW IN CONSOLIDATED POROUS MEDIA

THE FLOW OF HOMOGENEOUS FLUIDS THROUGH POROUS MEDIA

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OBSERVATIONS OF GAS FLOW IN POROUS MEDIA USING THE LIGHT TRANSMISSION TECHNIQUE

A novel technique was developed for studying gas phase flow in unsaturated porous media. Carbon dioxide was pumped through a back-lit chamber packed with translucent sand which was variably saturated with water containing the pH indicator dye methyl red. As the carbon dioxide dissolved in the pore water, lowering the pH and changing the dye color, a CCD camera captured images of the resultant changes in transmitted light. These digital image files were then processed using a series of calibrated steps to relate light intensity to dye attenuation, dye attenuation to solution pH, and solution pH to aqueous and gaseous carbon dioxide concentration. The final product was a series of false-color images showing the development of the gaseous carbon dioxide plume. Mass balance analysis of these images demonstrated several instances in which this method does not accurately predict carbon dioxide concentration due to, among other factors, sorption of the methyl red dye to the

sand and changes in optical properties between sand textures. However, the technique does afford the researcher an opportunity to observe carbon dioxide flow in response to textural and liquid heterogeneities. With refinement, this technique may prove to be a useful tool in studying the complexities of gas phase transport.

THE APPLICATION OF THE RELAXATION METHOD TO THE SOLUTION OF PROBLEMS INVOLVING THE FLOW OF GASES THROUGH POROUS MEDIA

"The purpose of this investigation is to determine the feasibility of applying the relaxation method of mathematical analysis to the solution of problems involving the flow of gases through porous media. The relaxation method was first applied to two-dimensional problems by Christopherson and Southwell, who applied it to problems in stress analysis. It was later applied to steady-state heat conduction problems by H.W. Emmons and to steady-state flow of incompressible liquids by A.A. Zwierschowski. The solutions of problems involving the flow of gases through porous media is difficult for all but the simplest boundary conditions, and impractical for many conditions, when the usual analytical means are employed. Consequently, the need for alternative methods of solution is evident"--Preface, leaves ii-iii.

MODELING PHENOMENA OF FLOW AND TRANSPORT IN POROUS MEDIA

Springer This book presents and discusses the construction of mathematical models that describe phenomena of flow and transport in porous media as encountered in civil and environmental engineering, petroleum and agricultural engineering, as well as chemical and geothermal engineering. The phenomena of transport of extensive quantities, like mass of fluid phases, mass of chemical species dissolved in fluid phases, momentum and energy of the solid matrix and of fluid phases occupying the void space of porous medium domains are encountered in all these disciplines. The book, which can also serve as a text for courses on modeling in these disciplines, starts from first principles and focuses on the construction of well-posed mathematical models that describe all these transport phenomena.

THE KINETIC THEORY OF GASES

Courier Corporation A pioneering text in its field, this comprehensive study is one of the most valuable texts and references available. The author explores the classical kinetic theory in the first four chapters, with discussions of the mechanical picture of a perfect gas, the mean free path, and the distribution of molecular velocities. Tbhe fifth chapter deals with the more accurate equations of state, or Van der Waals' equation, and later chapters examine viscosity, heat conduction, surface phenomena, and Browninan movements. The text surveys the application of quantum theory to the problem of specific heats and the contributions of kinetic theory to knowledge of electrical and magnetic properties of molecules, concluding with applications of the kinetic theory to the conduction of electricity in gases. 1934 edition.

DYNAMICS OF FLUIDS IN POROUS MEDIA

Courier Corporation This is the definitive work on the subject by one of the world's foremost hydrologists, designed primarily for advanced undergraduate and graduate students. 335 black-and-white illustrations. Exercises, with answers.