ABSTRACT

The Development of a
Transient-State Gas Permeameter

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The need for more effective reservoir control in enhanced oil recovery projects, and in screening programs for tight gas sands has created a growing demand for reliable gas permeability determinations. These measurements are routinely carried out on core samples using the conventional steady-state permeameter: a popular instrument with a simple design and easy operation. As data are ordinarily taken at only one flow rate, determinations are rapid; but this can lead to serious errors due to Klinkenberg (slip) and gas turbulence effects. Experimental correction methods improve accuracy, but these are often tedious and time-consuming. The need is clear for a more rapid, yet accurate permeameter.

On the premise that pressure measurements are made more conveniently and accurately than rate determinations, a permeameter has been developed in which both rate and pressure drop across a core can be

derived from pressure measurements alone. Klinkenberg (slip-corrected) permeability, k_1, Klinkenberg slip factor, b, α turbulence factor, and β (Forchheimer) turbulence factor can all be determined from a single run. This thesis presents the theoretical background, design, construction, and operation of such a permeameter: the Transient-State Gas Permeameter.