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MEASUREMENT OF "ROCK PROPERTIES" IN COAL FOR COALBED METHANE PRODUCTION

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ABSTRACT

Standard laboratory techniques for measurement of rock properties (porosity, permeability and gas-water relative permeability) must be modified when applied to coal for use in coalbed methane reservoir engineering studies. Coal is unlike most conventional reservoir rock in that fluid flow occurs in a network of naturally occurring microfractures or cleats. Drying coal alters the cleat structure. Therefore, a miscible displacement technique, in which coal cores are not dried, was used to determine an upper limit for cleat porosities of around 2% for cores from coalbed methane wells. There is no significant difference between the cleat porosity measured with the miscible displacement technique and the mobile water porosity for a coal core, indicating there is little or no irreducible water saturation in the cleat network. (The mobile water porosity is the volume of water which is driven out of a water-saturated core by helium injection divided by the bulk volume of the core.) Absolute permeability to water in coal cores can decrease with continued flow by an order of magnitude, probably due to fines migration. Unsteady-state gas-water relative permeability techniques can be modified to handle both the small volumes of water produced from cores with less than 2% porosity and the decreasing absolute permeability. Representative unsteady-state gas-water relative permeability curves for San Juan and Warrior Basin cores which have been used in coalbed methane reservoir engineering studies are presented. In steady-state gas-water relative permeability measurements using sodium iodide as a tracer, sodium iodide adsorption on the coal surfaces will result in systematic error in saturation values. However, within the experimental error with which saturations in the cleat networks can be determined, unsteady-state and steady-state with sodium iodide gas-water relative permeability measurements yield the same results.