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Kashy Aminian

West Virginia University, USA

Experimental evaluation of the Marcellus shale properties

Unconventional shale reservoirs play an enormous role in hydrocarbon production in the United States. Among the shale gas producing plays, Marcellus shale has a growing contribution due to advances in horizontal drilling and hydraulic fracturing techniques. Even though the advances in these technologies have unlocked the gas contained in Marcellus shale, the quantification of the petrophysical properties remain challenging due to complex nature of the shale. Reliable values of the shale petrophysical properties including permeability and porosity are necessary for accurate estimation of the original gas-in-place, prediction of the production rates and optimization of the hydraulic fracturing treatments. Unsteady state methods have been extensively used to estimate permeability of the shale samples because the shales typically have permeability values in Nano-Darcy range. However, the permeability values determined by these techniques have been found often to have large margin of uncertainty which are attributed to the lack of consistent experimental protocols and the interpretations issues. In this study, Marcellus shale petrophysical properties were successfully measured using a laboratory set-up, referred to as PPAL (Precision Petrophysical Analysis Laboratory) here, which has been demonstrated to provide accurate and repeatable measurements of the shale petrophysical properties. The PPAL measurements are performed under steady-state isothermal conditions flow conditions and the analysis of the results does not require complicated interpretations such as those for pulse-decay or GRI methods. The key advantage of the PPAL is the capability to measure the permeability and porosity of the shale core plug under a wide range of confining and pore pressures. The core plugs used in this study were made available through the Marcellus Shale Energy and Environment Laboratory (MSEEL). MSEEL is a dedicated field laboratory in the Marcellus Shale which has been established with purpose of providing a unique opportunity to undertake field and laboratory research to advance and demonstrate new subsurface technologies and to enable surface environmental studies related to unconventional energy development. The field site contains several horizontal Marcellus Shale wells and a vertical well (science well) drilled specifically for obtaining core and log data for scientific purposes.

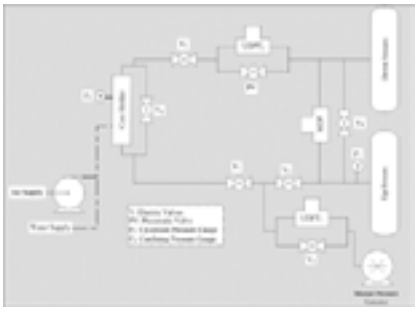

Figure-1: Schematic representation of PPAL

Biography

Kashy Aminian is currently a Professor of Petroleum and Natural Gas Engineering at West Virginia University. He has 40 years of distinguished service in both industry and academia. He holds MS and PhD degrees both from University of Michigan, USA. He has extensive research and teaching experience in the areas of unconventional natural gas resource development and reservoir engineering.

kashy.aminian@mail.wvu.edu