Flow Units for Shale Gas Formations: An Innovative Vision

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Hundreds of core data from shale formations in North America suggest that shales can be represented by flow units that posses distinct properties as compared with tight and conventional gas formations.

Although there is not a clearly defined protocol for determination of porosity and permeability from shale cores, and laboratories perform the measurements using different methodologies, the data compiled by the GFREE research team at the University of Calgary from different sources show imperfect, yet reasonably well defined empirical trends that can be used for distinguishing viscous-dominated flow in conventional rocks from diffusion dominated flow in shales.

Nanoports dominate in shale formations (port = pore throats) while megaports, macroports and mesoports are dominant in conventional rocks. The empirical trends from core data are corroborated with theoretical results obtained from mathematical simulations at the pore throat level. The distinction of viscous vs. diffusion type flow is valuable for example in those cases where the formation to be developed is composed of alternating stacked layers of conventional, tight and shale gas, or where there are lateral variations due to facies changes.

Another important observation is that volumes of original gas-in-place in shales and, more importantly, gas recovery volumes are potentially larger than considered previously, and also in the recent literature, because of the presence of important pore networks within the organic material of the shale. These pore networks lead to larger volumes of free gas within the shales not considered previously.

It is concluded that there is significant potential in the use of process speed as part of the flow unit characterization of unconventional gas reservoirs including shales.