Permeability Model using Minifracture Analysis in Tight Sands of Mature Fields

José Pajuelo[1], D. Escobedo[1], and G. Moreyra[1]

[1]CNPC Perú

Abstract

The permeability is one of the most difficult parameters to estimate in the tight sands reservoirs of mature fields of the Peruvian Northwest. Most of Build Up Tests (BU) were ineffective for estimating permeability because they did not reach radial flow. Since their values are in the order of 0.01 to 1 md, all reservoirs are stimulated with hydraulic fractures. In these operations, injection test time usually ends up at fracture closure pressure, making difficult the use of traditional method of After Closure Analysis (ACA) for dealing with permeability.

The study shows the development of a permeability model based on a Minifrac Analysis Methodology in Tight Sands Reservoirs of the Peruvian Northwest. Minifrac Analysis is a useful alternative because it is performed for each reservoir stage and estimates permeability using before and during fracture closure data.

The methodology is based on the application of two analysis methods. Modified Mayerhofer Method (Mayerhofer, Valko and Economides, 1999) uses available information before fracture closure. Empirical Correlation Method (Barre, 2007) uses information during fracture closure. Both methods calculate permeability as a function of the closure pressure, which is initially estimated using the G function.

For developing the model, 130 Minifrac tests were analyzed. These analyses showed that for a closure pressure, both methods converge in one permeability value. The results have been validated with some data from BU, K-Phi laws and facies distribution maps. All these allowed defining a clear permeability trend for each reservoir analyzed.

The results obtained have led complement the high resolution stratigraphic model and developed a Permeability Model in the study area. This methodology can be applied for permeability characterization in fields with similar characteristics, optimizing the use of information generated during Minifrac.