An Integrated Petrophysics and Geomechanics Approach for Fracability Evaluation in Shale Reservoirs and Complex Carbonates, Including the Mississippian Lime of Oklahoma and Kansas

Xiaochun "Jacob" Jin[1], Subhash Shah[1], Jean-Claude Roegiers[1], and Bo Zhang[2]

[1]University of Oklahoma
[2]Michigan Technological University

Abstract

The identification of the fracture barrier is important for optimizing horizontal-well drilling, hydraulic fracturing, and protecting fresh aquifer from contamination. The word "brittleness" has been a prevalent descriptor in unconventional-shale-reservoir characterization, but there is no universal agreement regarding its definition. Here, a new definition of mineralogical brittleness is proposed and verified. To save costs in expensive dipole sonic and mineralogical logging services and make best use of the limited logging data, correlations between mineralogical brittleness and porosity or sonic compressional slowness for typical shale plays are developed and proven.

Formation with higher brittleness is considered as a good fracturing candidate. However, this viewpoint is challenged because brittleness does not indicate rock strength. A new fracability index (FI) is developed to overcome the short-coming of brittleness by integrating both brittleness and energy dissipation during hydraulic fracturing. This FI con-siders that a good fracturing candidate is not only of high brittleness, but also requires less energy to create a new fracture surface. Field data of Barnett shale is applied (1) to verify the principle of the new brittleness definition and FI model, and (2) to demonstrate the process of screening hydraulic-fracturing candidates with the FI model.